SCIENTIFIC AMERICAN

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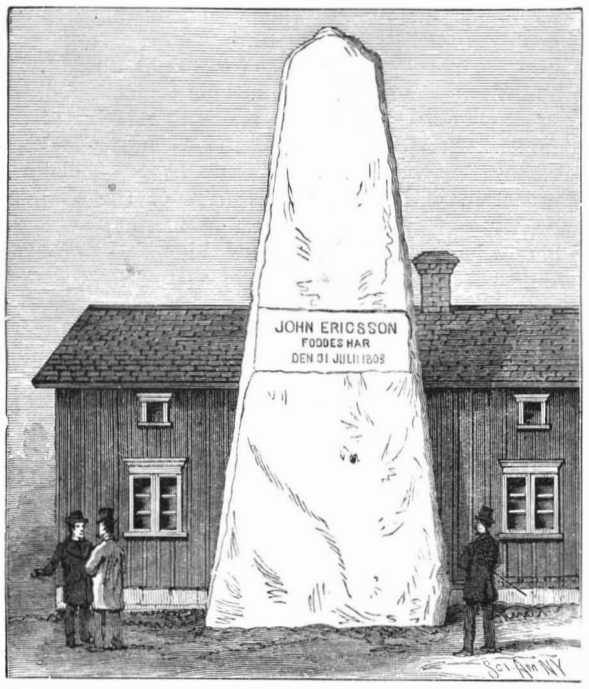
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LX.—No. 12. ESTABLISHED 1845. NEW YORK, MARCH 23, 1889. $3.00 A YEAR. WEEKLY.

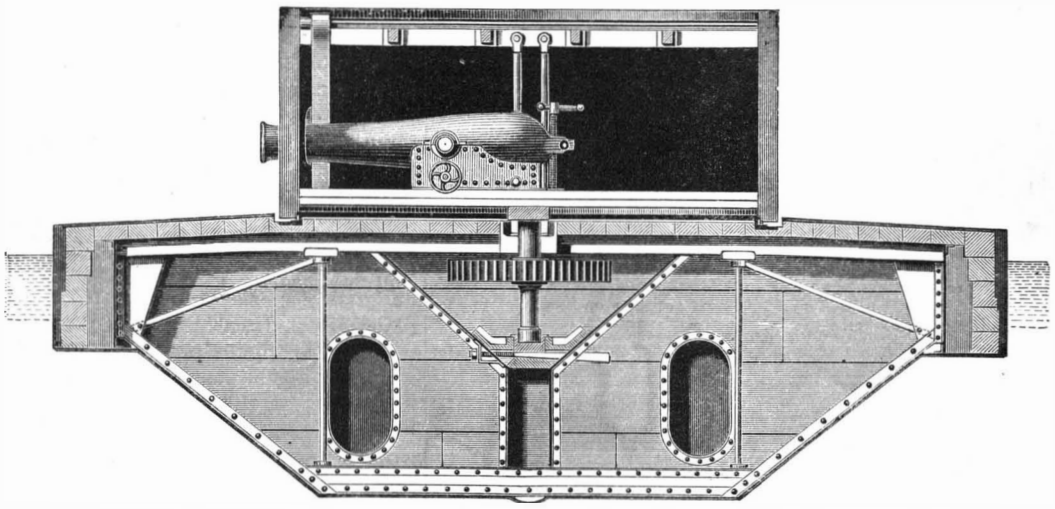
THE LATE CAPT. ERICSSON AND HIS WORK.

There are but few men who, as engineers and inventors, have been so long and so prominently before the public as the late Capt. Ericsson, whose death, on the 8th inst., was recorded in the last number of the SCIENTIFIC AMERICAN. He actually began in earnest his real life work very near the commencement of the century, when only about nine years of age, and did not lay it down until his brief final sickness, a few days ago, before which time he was apparently as full of vigor and as prolific of ideas as at any period since his childhood. It is said of William Pitt, the great English prime minister, that he used to quote from Greek and Latin authors, and gravely discuss state matters with members of Parliament, at the early age of seven years. Similar, it may be said, was the precocity of young Ericsson in the comprehension of mechanical principles and the appreciation of mathematical problems at an age when most children are occupied with their playthings.



ERICSSON'S BIRTHPLACE AND MONUMENT ERECTED BY SWEDISH GOVERNMENT.

When nine years old he first learned the use of drawing instruments, and how they were employed to lay out the work of construction in advance. His father then removing to the depths of a pine forest, where timber was to be cut for the great canal of Sweden, the resources of the young artist became limited to a pen and pencil; but he made compasses of birch wood, with needles in the ends of the legs, converted a pair of steel tweezers into a drawing pen, and robbed his mother's sable cloak of enough hair for material for his brushes. Thus provided he made the drawings for a pumping engine to be operated by a windmill, and it was the drawing made under such circumstances that attracted the attention of Count Platen, the President of the Gotha Ship Canal, and resulted in his employment on that work, in the corps of Swedish mechanical engineers, when only twelve years old. While thus employed an attendant used to follow him with a stool upon which he stood to raise himself to the height of his leveling instruments. In 1815 he made the drawing of the Sunderland iron bridge, which Count Platen for years afterward delighted to show visitors, and up to 1826, when he resigned his commission in the Swedish army and took up his residence abroad, he was active in making great numbers of surveys and plans which have since been deemed models of their kind, and have formed the basis of much practical engineering work.



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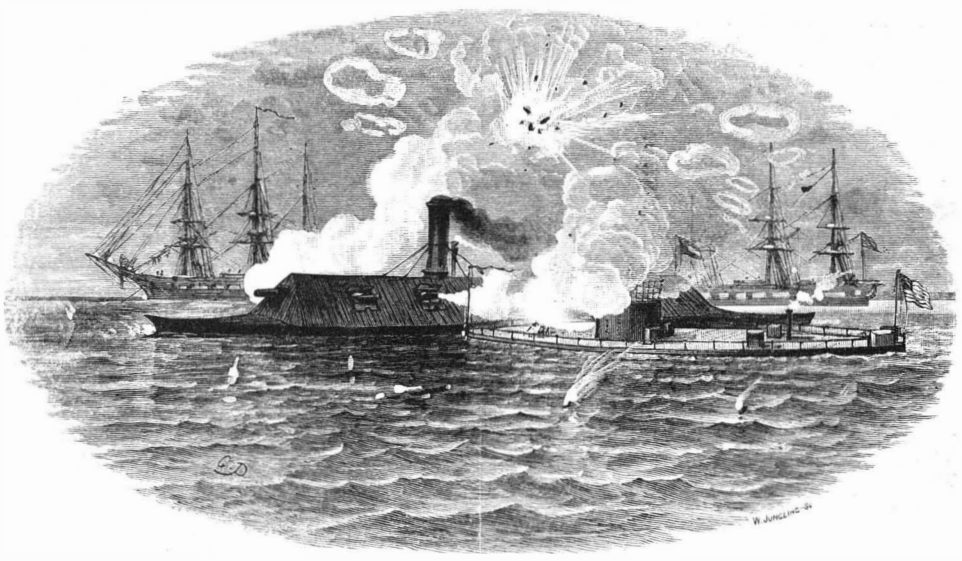
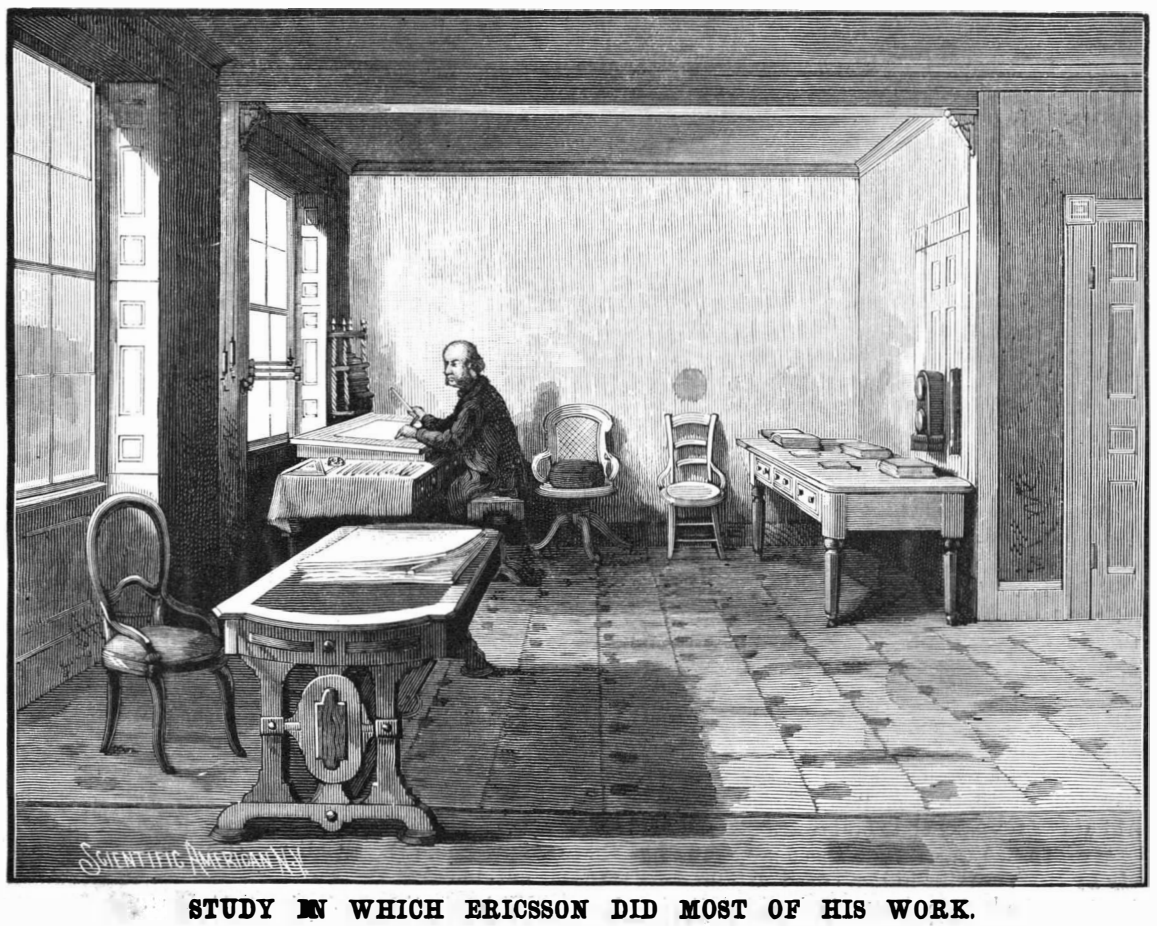


ENGAGEMENT BETWEEN MONITOR AND MERRIMAC.



STUDY IN WHICH ERICSSON DID MOST OF HIS WORK.

He arrived in England in 1826, having resigned his position in the Swedish army, and thereafter devoted himself solely to the engineering and scientific subjects which he continued to follow with so much energy throughout the remainder of his life. His first work in England was the endeavor to perfect a "flame engine," on which he had experimented much before leaving Sweden, but English coal produced a heat so much higher than he had before obtained from pine shavings as to destroy the working parts of the engine; and, under a new plan, an engine was completed and patented, which was sold to John Braithwaite, with whom he was afterward associated in the introduction of many of his inventions. The wonderfully quick time in which, at so early a period in the practical use of steam, Ericsson made the plans and constructed the "Novelty" locomotive has been already referred to. We give an illustration of this engine, built in 1829, in seven weeks, and which is said to have made the remarkable speed of fifty miles an hour.

Ericsson spent thirteen years in England, and the patent office records there afford abundant evidence of his activity in bringing forward inventions during that period. We have referred in a previous article to many of these inventions—an instrument for taking soundings at sea, a hydrostatic weighing machine, an apparatus for making salt from brine, a rotary steam engine, a caloric engine, a practical system of artificial draught for steam boilers, a condensing engine, a method of superheating steam, the link motion for locomotives, etc. Perhaps one of the most important of his contributions to engineering science during this period was his plan of screw propulsion for vessels. Without claiming that he was the originator of this great improvement, it is certain that he gave to the world many new and valuable ideas as to the best

(*Continued on page* 182.)

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
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The Scientific American Supplement

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NEW YORK, SATURDAY, MARCH 23, 1889.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 690.

For the Week Ending March 23, 1889.

Price 10 cents. For sale by all newsdealers.

SATISFACTORY PROSPECTS FOR THE WAR VESSELS.

The recent achievements of the dynamite cruiser Vesuvius and the gunboat Yorktown, on their respective government trial trips, demonstrate something more than the mere certainty of acceptance of these vessels. To the William Cramp & Sons, it is sufficient to know that the vessels have proved a success, and to the government board, that the vessels have passed a satisfactory test. But to the public at large, to the ship builders of this country, and to builders abroad, the success of these two modern war vessels demonstrates the ability of American ship and engine builders to not only equal, but surpass those of foreign countries. When it is taken into consideration that the estimated speed of the Vesuvius and the estimated horse power of the Yorktown was placed as high in each case as it was supposed by the government officials possible for the contractors to attain, the wonderment is expressed that in each instance the contract requirements were exceeded far beyond the most sanguine expectations.

The Vesuvius was required by the government contract to make 20 knots per hour. On her official trial trip she made a mean of 21·646 knots per hour.

The contract requirements of the Yorktown called for a development of 3,000 horse power, with a provision that for every extra unit of horse power obtained, the contractors should receive a bonus of $100. On her official trial trip the Yorktown developed, as an approximate mean for a four hours' continual run in a seaway, not less than 3,650 horse power, though the designer of her engines, Mr. Horace Lee, is inclined to place the figure as high as 3,700, the findings of the official board being not yet made public.

The ability of the Cramps to turn out such successful vessels as the Vesuvius and Yorktown shows for itself that the American shipbuilders of the past have worthy representatives at the present day, for it is well known that the name which the famous clipper ships in the forties and fifties won for American builders placed the latter ahead of all other ship designers in the world. The breaking out of the civil war found the American navy consisting of a great number of unserviceable craft. Before one year had passed, every ship yard on the Atlantic coast north of the Delaware capes was taxed to its very utmost, gunboats were turned out complete and with their batteries in place in 90 days after the first laying of their keels, while Monitors were rushed through in six months' time.

As a result the close of the civil war found the navy of the United States possessing more ships than that of any other navy in the world; while the muster rolls bore on their faces the names of some 100,000 seamen, ready for service and duty afloat. It must also be remembered that the civil war developed a type of vessels entirely new to warfare. This was the Monitor type, which immediately after became so popular among the naval establishments of foreign governments. Russia especially seized hold eagerly of the new idea, and was followed in quick order by France, Germany, Spain, and Italy. Although the Monitor type in its original design is fast becoming obsolete, there are features of it, however, which promise to become permanent fixtures in the armaments of naval vessels. The turret, revolving or fixed, is a purely Monitor idea, and at the present day it is safe to say that one-fifth of the heavy armored war ships of Europe carry a steel or iron turret on the spar deck. The 100-ton guns on the majority of the Italian vessels are mounted in turrets; the guns of the Thunderer type of the British navy are likewise; while in the German navy the Friedrich der Grosse and Preussen, sister ships, each of 6,660 tons displacement, carry their respective four 22-ton Krupps in turrets, the thickness of metal ranging from 9 to 10 inches on different parts.

With the appearance of the dynamite cruiser Vesuvius among the vessels of this country's naval establishment, it is not at all unlikely that, before two years will have elapsed, several of the European governments will possess vessels of similar design, and intended for the same mode of warfare.

As it is now, the Cramps have received offers from foreign emissaries to build cruisers of the Vesuvius type, and it is understood that the firm has been offered as high as $500,000 for the original vessel itself. This latter offer could not, of course, be taken up by the Cramps, inasmuch as over two-thirds of the vessel's contract price has been paid down by this government. The Italians are especially anxious to obtain the Vesuvius. They have also conferred with the officials of the Pneumatic Dynamite Gun Company, with the express view of purchasing guns for use aboard their own ships, even if they be unable to buy the Vesuvius, or manage to have built vessels of similar type.

There has been evinced a tendency on the part of some persons to deny the Vesuvius the name she is so justly entitled to, that of "the fastest vessel in the world of her tonnage class and over." The only vessel afloat which has attained in speed anything like that made by the Vesuvius in her speed attainments is the Tripoli, of the Italian navy. This vessel displaced, on trial, 831 tons; the Vesuvius displaced 810 tons. The speed of the Tripoli was 20·1 knots over the measured mile, and less than 20 knots for the mean of a four hours' continual run. The El Destructor, of the Spanish navy, made a mean of 22·6 knots on a four hours' continuous run, but the El Destructor is less than 500 tons displacement, and carries little or no armament. The Vesuvius, on trial, was weighted down with 140 tons of armament.

Throwing the El Destructor out of comparison, which is only just and right, the Vesuvius presents herself to the world as an American-built ship, and one whose speed for her tonnage and over has never been exceeded. As for high horse power development per ton of machinery, boilers, and the like, the Vesuvius likewise attained to higher than ever got by any other vessel abroad having the same type of marine engines. She obtained an average mean of 16·9 horse power per ton of machinery, boilers, coal, and water in boilers. The best ever obtained abroad is placed at 12 horse power per ton, and an average of the best at 10 horse power. The Tripoli and El Destructor, however, carry engines of the locomotive type, and as for weight abroad, it is all in the machinery. It must be remembered, too, that no comparison is being made in relative attainments with torpedo boats of the Ariete type—boats built by Thornycroft. Such craft have no claim to comparison with sea-going cruisers of the Vesuvius type.

It now looks as if all the new ships of the navy are going to exceed the expectations of the Navy Department. The Petrel is likely to make 250 horse power over and above her contract requirements. This will give the contractors a bonus of $25,000. The Bennington and Concord vessels, of the Yorktown type, are designed for 3,400 horse power, and their contractors expect to attain from the engines a development of 250 to 300 horse power over and above the stipulated number.

The four last years have done much to stimulate and encourage ship builders, and the success with which the latter are meeting promises to assure to them not only the confidence of the American people, but to serve also as an inducement for foreign purchasers to buy vessels of American build.

PROGRESS OF ELECTRIC ILLUMINATION.

For proof of the innate conservatism of the human family we have only to glance at the history of any great invention. Any innovation calculated to change old established manners and customs is sure to meet, at first, with opposition, and unless by actual trial it is shown to be desirable and advantageous, it dies and passes out of sight.

Every important invention passes through this ordeal. It is surprising, on taking a retrospective view of inventions that have proved of the greatest benefit to mankind, to note what struggles they have passed through before receiving anything like adequate acknowledgment from the public. On the other hand, when an invention has passed its period of probation, and is found desirable, its progress is rapid, and nothing can impede it. Several applications of electricity have reached this stage, and are progressing in a manner little dreamed of ten years ago by the most sanguine, and even now, very few, unless connected in some way with the industry, realize the extent of the adoption of the electric light and of electricity as a means of distributing motive power.

So far as we know, every city in the United States is provided with arc and incandescent illumination, and the introduction of electric lighting is rapidly extending to the smaller towns. Already hundreds of villages of only a few thousand inhabitants have their electric light plant. In many instances the electric light has been placed in competition with gas light, while in other cases it has been introduced to advantage where gas light was impracticable. In all these applications the economical distribution of power for small uses by means of the electric motor is a very attractive and important feature.

In addition to the general plants adopted by cities and villages, there are thousands of isolated plants for single buildings or groups of buildings, and electric lighting has been largely adopted by steamboat and railway lines. For isolated plants the storage battery is coming largely into use, the batteries being connected by day for charging with the arc lines, and used at night for incandescent lighting.

In addition to these applications of electricity, we find it largely employed in the mining districts, the generators being located upon the surface and the motors in the depths of the earth. Electric tramways are also of great utility in transporting ore and other materials, but a larger use is that of driving cars upon the street railways. Electric cars are now regularly manufactured, and they are in use not only in the cities, but in the small towns and villages. The extent to which this method of propelling cars has been adopted, and the rapidity with which it is progressing, is notable.

With all the perfection that has already been attained in electrical machinery, improvements are con-

stantly being made, and there is doubtless still great room for further improvements.

Storage batteries for stationary lighting and power have reached great perfection, but there seems to be opportunity for improvements looking toward decrease of weight and greater durability under constant jarring and agitation.

A well known street railway magnate said to a representative of the *Electric World*, the other day, "What we are looking for is a good, serviceable, commercially practical, storage battery. We have numerous storage batteries, some good, others indifferent, but all of great value in the laboratory. Now, give us something cheap and practical. There is nothing the matter with the overhead and underground systems of street railways, but what is wanted is a system in which we can convert our present cars into electric tramways, and go on running without all this fuss about overhead wires, underground cables, and a hundred annoying details. We have all the practical motors that can be desired, but what is needed is a storage battery that has a good life, high efficiency, light weight, convenient form for handling, and that will be guaranteed. Then will come the era of swift, sure, safe, and pleasant surface traffic."

PRESENT ASPECT OF INVENTION.

A correspondent has written to us asking whether the realm of invention is not exhausted—whether there is still any chance for one of an inventive mind to devise improvements on existing devices or machines. The doubt implied in the above question seems very natural in view of the record of the patent offices of different countries. Every year sees an increase of patents. Besides these there are numberless inventions that are unregistered and that do not find a place on the records. Notwithstanding all this, the field is so large, and is so imperfectly cultivated, that the work has only commenced. Man's energies now, after so many years of waiting, are bent on the subjugation of the material world. More than half a million patents are the written history of what has been done, but the unwritten portion is the largest. Yet the conquest is far from complete.

If we consider the great inventions that are waited for, perhaps the subject of a prime motor would be the first occurring to the mind. From every point of view the steam engine is unsatisfactory. It is hampered by the condition of a narrow range of temperature, so that with steam of any manageable degree of heat, not more than fifteen or twenty per cent of the heat of the fuel can possibly be utilized. There is only one way in a heat engine to avoid this restriction. It is to use a very high temperature in the motor. If steam is greatly superheated, it attacks the metal of which a machine is built, it destroys lubricators and packings, and is quite impracticable. Steam cannot overcome the ill effects of the second law of thermodynamics. In the gas engine, in which the combustion of gas is directly used, a higher temperature is obtained, and an engine far more economical in the calorific sense is obtained. But its fuel is expensive, and has to be first manufactured. The cylinder becomes heated, and, to prevent this from going too far, water is caused to circulate around it. This is a concession to the practical, for theoretically the use of water in this place is wrong. Neither the steam engine nor gas engine fills the bill. A prime motor that will convert eighty or ninety per cent of the heat energy of coal into mechanical energy has yet to be invented.

Another conversion of energy should be the subject of invention. Mechanical energy can be converted into electrical energy with little loss; the problem of a successful conversion of heat energy into the electric form has yet to be solved. The ordinary thermo-electric battery is exceedingly uneconomical, on account of the small difference of temperatures that it can utilize, and, in all of its present forms, must have a low coefficient of restitution. Of all the heat energy which it absorbs, it cannot restore as much even as the steam engine does. A prime motor and a direct converter of heat into electricity, with efficiencies of eighty per cent or more, and using common fuel, have yet to be invented. In the ordinary cycle, coal is burned under a boiler, and the steam thus generated actuates an engine, in its turn driving a dynamo. In the second conversion of mechanical into electric energy, there is a loss of not over ten or fifteen per cent. But in the first step eighty-five to ninety per cent of heat energy is lost. In overcoming this loss, by going directly from heat to electricity, without the wasteful intermediation of steam, there is ample room for invention.

A primary battery that would be economically available for heavy work has yet to be invented. Almost all are characterized by high resistance, expensive depolarizer, or a negative plate of high initial cost. In the Upward battery there was a genuinely new departure, but it has not been extensively introduced. The use of zinc for the positive element is a weak point, owing to the expense of such fuel. The storage battery has meet with success, in great measure, on account of its low resistance. In the approved arrangement of primary batteries, one-half the energy is expended uselessly in overcoming the resistance of the battery itself. Several attempts have been made in the direction of advance in primary generator construction, in some cases carbon or some of its compounds being utilized as positive element. In a primary battery of cheap construction, of low resistance, comparable to that of a storage cell, and consuming a cheap positive element, there is a chance for invention of the highest order and economic value.

Even the storage battery is defective. The spurious voltage represents a loss of ten per cent, and its excessive weight and deterioration tell heavily against its more extensive introduction. No one can pretend to say that the climax has been reached in it. The future must have a battery in reserve whose active portions shall bear a more favorable ratio to the weight of the inactive portions.

The field of greater achievements could be gone over and many other wants suggested. The sun's radiant heat should be utilized; tidal force and the movements of the wind should be harnessed and made to do their part in the labors of the world. In considering the great advance of natural science as regards definition only, remembering how accurately the extent of achievement is stated, it is impossible to resist the conclusion that the world is on the verge of the revealment of some of the greatest inventions. To know just what we have done and what are the limits of our power in any given direction, is half the battle, and that half has been won.

In inventions of minor or less fundamental character the field is widening rather than narrowing. Since the days of Faust and Gutenberg, all books have been set up, letter by letter, in the most laborious and primitive way. At last a fairly successful type moulding machine that replaces the compositor has appeared. But no one can pretend to say that it marks the limit of achievement in this particular art. In the most numerous classes of inventions, such as car couplers or lock nuts, there is evidently ample region for work, as certainly the perfect coupler or nut has not yet been invented.

About 1812 Robert Fulton is said to have invented means for bringing the double-ended ferryboats which he had designed to their pontoon docks without a jar. As the ferryboat of the present day reaches her pier, the ends of two cables brought from the dock are hooked to eyebolts on her deck, and the cables are then tightened by a species of windlass so as to hold the boat in place. The whole operation is executed by hand, while several hundred people patiently await its completion. In this exceedingly crude contrivance it would seem that a relic of Robert Fulton's invention has been preserved. The ingenuity of the constructors of steamships and railways ought to be adequate to the production of an automatic coupling that would hold the boat in place as she touches the dock.

A good instance of a genuine improvement in a field apparently barren has been afforded during the last few months. The channel eye was one of the first improvements in the needle. By placing the eye near its point, the sewing machine became a possibility. Except for these changes, the latter for a specific purpose, the little pointed piece of steel has remained the same for many generations, and has served as a trial of patience to many of the weaker-sighted mortals who have attempted to thread it. It seemed a hopeless thing to expend ingenuity on. Needle threaders were invented, but proved of little use, and it is within a few months only that a self-threading needle has been placed upon the market.

We think it is evident that the horizon of the inventor's world is widening. Every great change or invention opens a new region, and a fundamental patent is often the basis for numerous and profitable improvements and additions.

THE PRATT INSTITUTE OF BROOKLYN.

In our issue of October 6, 1888, we described the Pratt Institute in detail and fully illustrated its various departments, devoting nearly an entire issue to the subject. We have since then watched the progress of this school with much interest, as we believe this and similar institutions are to play an important part in the future of our industries, and further than this they are to disseminate technical knowledge among all classes.

An inspection of the Institute during a recent reception revealed the fact that a great deal had been done in the organization of the various departments and getting them in thorough working order. The exhibits of objects produced by the students in the several classes indicated a marked advance over those shown last year. The cooking school was in full operation, and judging from the cleanly and orderly appearance of everything in the kitchen, the deft manner in which the cooking operations were carried on, we would suppose that a graduate from this department might be able to satisfy an epicure.

In the art department a number of creditable exhibits were shown, and the same may be said of the department of mechanical drawing. Wood carving is a new branch recently introduced; a number of fine specimens of carving were on view. The department of millinery and dressmaking showed specimens of handiwork which would do credit to some of our fashionable establishments. Type writing and stenography were being taught to bright-eyed lads and misses. The wood-working and machine department are in thoroughly good order, and various kinds of wood and iron work were being carried on. The blacksmith's shop and the foundry were in full blast. In the trade schools were to be seen students laying brick, plastering walls, cutting and carving stone, plumbing, etc.

In the hall of the new Ryerson Street entrance were to be seen samples of work done by the students in the School of Mechanic Arts. Among these were specimens of plumbing, blacksmithing, pattern making, cabinet work, etc.

The Technical Museum is one of the very interesting features of the Institute. Here are to be found the crude materials and the manufactured articles in various stages, arranged in the order in which the processes are carried on. There are also specimens of rocks and minerals. A set containing specimens of all known elements.

Among the new additions are to be found an exhibit of zylonite; an interesting exhibition of the Edison lamp in the various stages of manufacture; a fine set illustrating the manufacture of American faience; another set of textile fabrics, laces, and embroideries. The museum is open on certain afternoons and evenings of the week, and is free to all who wish to visit it.

We cannot pass through this great institution and examine the various departments critically without feeling that its founder has conferred a great benefit upon the city of Brooklyn and vicinity.

Meteorites.

Professor Darwin recently delivered, at the Royal Institution of Great Britain, a lecture on "Meteorites and the History of Stellar Systems." The lecturer, referring first to the advantages now enjoyed by astronomers from the application of photography, said that we might reasonably hope to obtain some information as to the process of development of the stars and planets. He then explained the nebular hypothesis of Laplace, who supposed the solar system to have originally consisted of a mass of gas in rotation. As the gas cooled it contracted and rotated more rapidly, until at length it became so much flattened that it could no longer subsist in a single shape. A ring was then shed, and the contraction of the central portion continued until a second crisis arrived, when another ring was detached. A succession of rings was formed, and these coalesced subsequently into planets, while the central portion formed the sun.

A recent photograph of a nebula in Andromeda, by Mr. Roberts, was then exhibited. In it could be seen the central condensation, the successive rings, and planetary nebulæ already formed. The speculation of Laplace appeared thus to be actually proved. The truth of this hypothesis involves the gaseous constitution of the nebulæ, but the recent researches of Mr. Lockyer and other considerations now render it almost certain that the immediately antecedent condition of the sun and planets was not a gas, but that they consisted of a swarm of loose stones or meteorites. There is thus apparently an absolute contradiction between the nebular hypothesis and the meteoric theory. The object of the lecture was, however, to point out that these two views may be reconciled with one another. The lecturer then suggested that in a celestial nebula the collisions of meteoric stones may play the same part as the collisions of gaseous molecules in ordinary air, and that in this manner a gaseous character may be imparted to a celestial nebula, although it may not consist of gas at all.

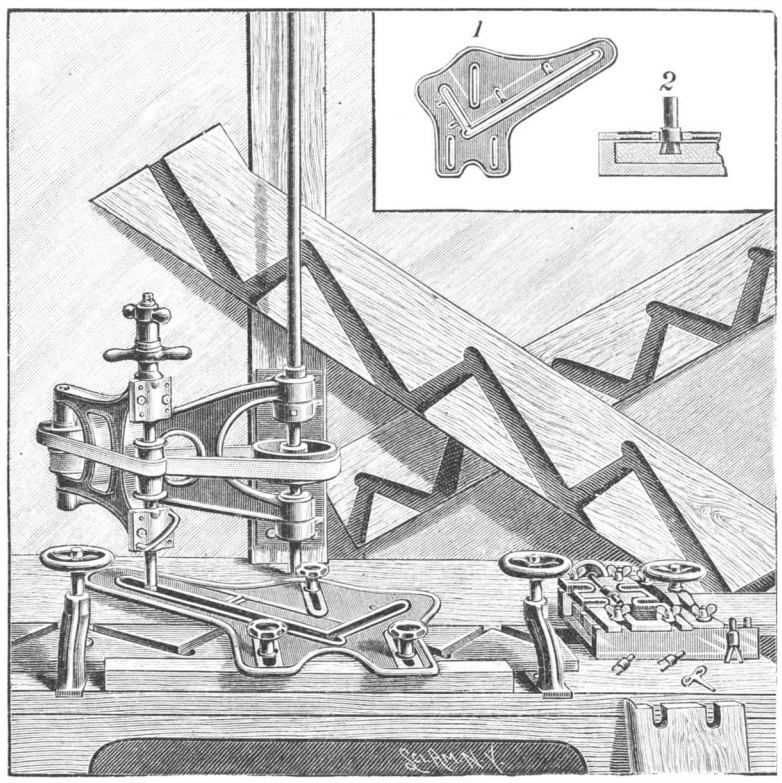
Proceeding to examine the details of this hypothesis, Professor Darwin arrived at the conclusion that the collisions of meteoric stones would be sufficiently like those of molecules to satisfy the conditions of the hypothesis. He maintained, therefore, that we are justified in believing in the substantial truths of the nebular hypothesis while still holding that stellar nebulæ consist of a swarm of loose stones in frequent collisions with one another. In conclusion, he spoke on the zodiacal light, on comets, and on shooting stars as evidence of the continued existence of meteorites in the solar system. These stones may be characterized as the dregs and sawdust of the system, the great majority of stones having been absorbed in the formation of the sun and planets.

SOME people are disposed to sneer at inventors and patents. Don't do it! Nine-tenths of the material prosperity of this American Union is due to inventors and their patents. A volume would not suffice to relate the many obligations we owe to the men whose patient investigation and ingenuity have cheapened processes and lessened labor for this prosperous people. Rather let us remove our hats before the man who has devised a machine by which we may get bread with less sweat. —*Safety Valve.*

AN IMPROVED ROUTING MACHINE.

The machine represented herewith embodies two patents issued to Mr. William H. Parry, and has been especially designed for stair builders' use in gaining the wall string to let in the treads and risers, and for dovetailing the treads to receive the balusters. In laying out the wall string, it is only necessary to lay off the face lines, as the templet, shown in Fig. 1, can be set to allow for any size of wedge the stairbuilder may wish to use. This templet is adapted to work any length of tread, either right or left hand, winders included, and when once set need not be changed again for any number of strings of that rise and tread, as the work is run under the templet and firmly held by two clamps while a tread and riser are being worked. The machine is provided with two bits, shown in Fig. 2, which work as well on hard as on soft wood. It is said that with this machine a string with sixteen or eighteen risers can be routed inside of fifteen minutes, while the cutters do not knock off the finished corners, which the stairbuilder finds it difficult to keep perfect when routing out by hand. The spindle is so arranged that all lost motion is taken up by two check nuts at the top of the spindle.

For further information relative to this machine address Mr. James H. Havens, No. 825 Eleventh Avenue, New York City.



PARRY'S ROUTING MACHINE.

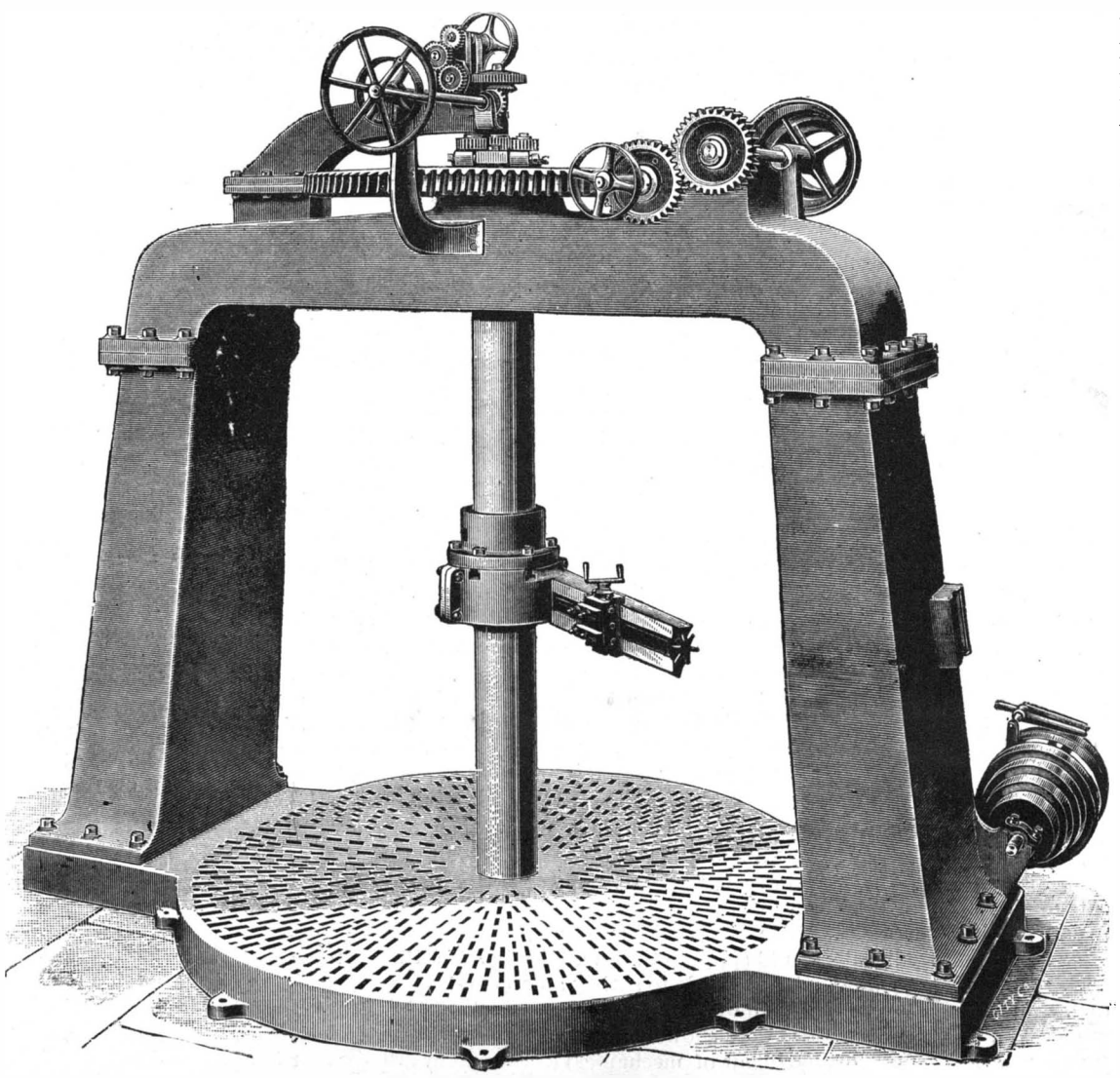
A Country of Small Things.

Japan, says Mr. Frank G. Carpenter, is a country of the little. "The men here are from five feet to five feet five inches high, and the women are smaller. Notwithstanding the fact that they raise themselves three inches off the ground on their wooden sandals, I am continually looking down at them, and a fair sized American girl towers above them like an Amazon. Japanese trees are dwarfed, and, in fact, all nature seems to be made on the six by nine plan. The chickens are nearly all bantams, and the cats, with their bobtails, look like kittens compared with our American tommies, and the horses are ponies. The houses of the common people are but one story, and the rooms look like children's play houses. The country, though as big as several States, is full of picturesque scenery, but it is the pretty rather than the grand, and you have beautiful bits rather than sublime landscapes. It is the same with everything. If I ask for a cup of tea at a little wayside tea house, it is handed to me in a little piece of shell-like china, no bigger than an egg-cup, and the little Japanese beauty goes down on her knees when she brings it."

IMPROVED VERTICAL CYLINDER BORING MACHINE.

Our illustration shows a very strong and powerful vertical cylinder boring machine, made by Messrs. Francis Berry & Sons, Sowerby Bridge. This machine is capable of boring cylinders from 2 ft. 6 in. to 12 ft. in diameter and 10 ft. high, and from 17½ in. in diameter to 2 ft. 6 in. in diameter by 2 ft. 9 in. long for stuffing boxes, etc. It is fitted with a boring bar 16 in. in diameter, with one boring head about 4 ft. 11 in. in diameter, and is also fitted with a compound slide rest for facing the ends of cylinders up to 12 ft. in diameter. The boring bar is so arranged that it can be lifted out through the top bearing without disturbing the main driving gearing. The boring head can be quickly raised and lowered by hand or power. The feed is self-acting, and is made variable by a set of change wheels from 4 to 16 cuts per inch. As will be seen from the illustration, the machine stands upon a massive cast iron bed plate, truly planed, with bolt slots for fixing the work to be operated upon. It is driven by powerful worm and worm-wheel gearing, and is provided with cone pulleys and fast-and-loose pulleys. The approximate weight is 33 tons.

The machine was constructed for a large engine works at Barcelona, where it is employed in boring marine engine cylinders.—*Engineering.*



IMPROVED VERTICAL CYLINDER BORING MACHINE.

Quick-Firing Guns for Fortresses.

General Lord Wolseley presided at a lecture delivered at the Royal U. S. Institution, on the above subject, by Captain F. Gleadowe Stone, who in the course of his lecture said:

Our extreme vulnerability as a naval power in the days of sailing ships, when our strength by sea in proportion to that of other European powers was infinitely greater than it is now, may be gathered from the fact that between the years 1793 and 1800 no less than 4,314 British ships were captured. Lloyd's register shows that nearly 700,000 British ships enter or leave our home ports annually, that the value of this shipping is £93,000,000, and that the value of the imports and exports is £618,000,000, no less than £140,000,000 of the imports being food. By the aid of quick-firing guns and the position finder we are enabled to carry out the ideal system of defense, viz., few guns in dispersed emplacements concealed by natural features. This system has long been advocated by Sir Andrew Clarke, and it is difficult to see how any further opposition can consistently be offered to it.

At some competitive trials carried out last year by the Admiralty between a 4¾ inch quick-firing gun and a 5 inch service breech-loading gun, the former fired 10 consecutive aimed rounds in 48 seconds, while the latter took 5 minutes 7 seconds to fire the same number. It does not appear necessary that quick-firing guns for this kind of defense should be of very large caliber; probably a 5 inch gun, throwing a projectile of about 40 pounds, would be the maximum required, giving a penetration of 12 inches into wrought iron. Any attempt to go beyond this for the purpose of obtaining higher penetration would be misplaced, though doubtless quite feasible; in fact, a 12 pounder quick-firing gun would serve most purposes, and the results already achieved by the 6 pounder Hotchkiss are instructive on this point.

At Eastbourne a shell from one of these guns struck the chase of a 10·4 inch breech-loading gun and penetrated into the bore. At Shoeburyness a 9·2 inch breech-loading gun was struck on the chase, and a bulge of nearly half an inch raised on the interior of the bore, thus rendering it unserviceable. There are two objections commonly raised to the employment of quick-firing guns: 1. The smoke. 2. Complicated mechanism and liability to get out of order. With regard to the first point, if the smoke hangs over any gun, it is impossible to lay it, but in the case of the quick-firing gun we can at any rate get in more shots than with the ordinary gun, inasmuch as the laying is not disturbed, besides which, the fact of our powder being bad is no argument for discarding all improvements in gun making.

Other speakers advocated the use of the 6 pounder quick-firing gun. Lord Wolseley declared that, in his belief, nearly the whole of the existing fortifications in Europe were no better than if they were constructed on sand hills, in the presence of modern guns.

Money in Inventions.

"One of the best opportunities for a young fellow to make money quickly in these days," said a self-made millionaire of this city to the writer recently, "is to rack his brains until he has invented something useful or that the public wants. A general impression prevails that it takes a skilled engineer or a man of phenomenal inventive ability to develop anything useful to manufacturers in this age of machinery. But there is a wide field open to shrewd amateurs, so to speak, to supply little articles of convenience to housekeepers, shopkeepers, etc., and designers can be had at reasonable rates to execute the idea, once it is conceived. American women are so accustomed to getting what they want that anything which lightens their labors in the household is sure to 'go.' When I was a boy on the farm at home, my mother used to make me clean all the dinner knives on Sunday with bath brick. Now, scraping this brick into a fine powder, without lumps in it, used to be the most tedious part of the whole work. The other day I heard of a man who has made a fortune by supplying the trade with powdered bath brick in neat packages. You know how difficult it is to pick up small coins from a wooden counter. Yet the whole civilized world has growled at and endured it since coins were stamped and counters made, until the other day a young fellow invented a rubber mat with little bristles of rubber standing up thickly all over it. Coins thrown on the mat are as easily picked up as if they stood on edge. The public was quick to appreciate it, and the inventor need not work for a living any longer."—*New York Tribune.*

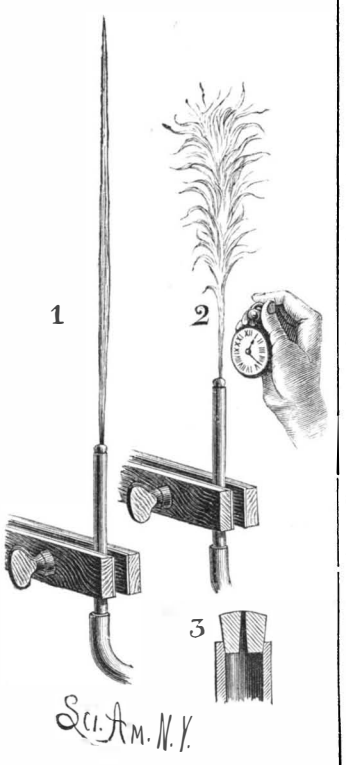
A New Method of Teaching Chemistry.

There may be more method than madness in the longing of the American student for a finishing course at a German university. At a recent discourse on chemistry, Prof. Heinrich Hoffman, of Berlin, illustrated the atomic constitution of organic compounds by the use of the ballet. Each girl was dressed in an individual solid color and represented an atom, and the grouping and movements of the atoms is said to have been very effective. Chemistry has now become a very popular study with the students, and the attendance at the lectures very full.

SENSITIVE FLAMES.

BY GEO. M. HOPKINS

The sensitive flame observed by Dr. Le Conte and afterward developed by Tyndall exhibits some of the curious effects of sound. For its production it is necessary that the gas be under a pressure equal to that of a column of water six or eight inches high. The common method of securing the required pressure is to take the gas from a cylinder of compressed illuminating gas, such as is used for calcium lights. Another method is to take the gas from a weighted gas bag, and still another is to fill a sheet metal tank with gas and displace it with water in the manner illustrated in Fig. 4.



BURNER FOR SENSITIVE FLAME.

The burner is shown in Figs. 1, 2, and 3. It consists of a small tip inserted in the end of a suitable tube. The tip in the present case is made of brass, but those commonly used for this purpose are of steatite. They are superior to the metal ones, but quite expensive. The writer is indebted to Professor W. LeConte Stevens, of Brooklyn, for a hint on this point. Professor Stevens has found that some of the lava pinhole burner tips used in certain kinds of gas stoves answer admirably for this purpose, and cost very little. A tip with a round, smooth hole is to be selected. The bore of the tip is here shown tapering. Its smaller diameter is 0·035 inch. The burner is supported in the manner shown in Figs. 1 and 2 or in any other convenient manner, and gas under a suitable pressure flows through and is ignited. The flame will be tall and slender as shown in Fig. 1. By regulating the gas pressure carefully, an adjustment will be reached at which the flame will be on the verge of flaring. A very slight increase of pressure beyond this point will cause the flame to shorten and roar. When the flame is at the point of flaring, it is extremely sensitive to certain sounds, particularly those of high pitch. A shrill whistle or a hiss will cause it to flare. The rattle of a bunch of keys will produce the same result. It will respond to every tick of a watch held near it.

Tyndall says that when the gas pressure is increased beyond a certain limit, vibrations are set up in the gas jet by the friction of the gas in the orifice of the burner. These vibrations cause the flame to quiver and shorten. When the flame burns steadily, any sound to which the gas jet will respond will throw it into sympathetic vibration. Experiment has demonstrated that the seat of sensitiveness of the flame is at the base of the flame, at the orifice of the burner.

The method of producing the required gas pressure illustrated in Fig. 4 is available when gas bags or cylinders of compressed gas are not to be had. A tin cylinder of about 15 gallons capacity is provided at the top and bottom with valves. The lower valve is connected with a hydrant, and the cylinder is filled with water, while the upper valve is left open to allow of the escape of air. When the cylinder is filled with water, the supply is shut off and a tube from a gas burner is connected with the upper valve and the gas is turned on. Then the water is allowed to escape from the cylinder, thereby drawing in the gas. When the cylinder is filled with gas, the valves are closed and the lower one is again connected with the hydrant, while the upper one is connected with the pinhole burner. The valves on the cylinder are again opened and water is admitted at the rate required to produce the desired gas pressure. Only two precautions are necessary in this experiment; one is to avoid a mixture of air and gas in the cylinder by driving out all the air, the other is to avoid the straining of the cylinder by water pressure.

Another sensitive flame, which has several advantages over the one described, is shown in Fig. 5. It requires no extra gas pressure, and it is more readily controlled than the tall jet. It was discovered by Mr. Philip Barry, and the discoverer's letter to Mr. Tyndall concerning it is found in Tyndall's work on sound. In the production of this flame a pinhole burner, like that already described, is employed. Two inches above the burner is supported a piece of 32-mesh wire gauze, about 6 inches square. The gas is turned on and lit above the wire gauze. It burns in a conical flame, which is yellow at the top and blue at the base. When the gas pressure is strong, the flame roars continuously. When the gas is turned off, so as to stop the roaring altogether, the flame burns steadily and exhibits no more sensitiveness than an ordinary flame. By turning on the gas slowly and steadily, a critical point will be reached at which almost any noise will cause it to roar and become non-luminous. Any degree of sensitiveness may be attained by careful adjustment of the gas supply. A quiet room is required for this experiment. The rustle of clothes, the ticking of a clock, a whisper, a snap of the finger, the dropping of a pencil, or in fact almost any noise, will cause it to drop, become non-luminous, and roar. It dances perfect time to a tune whistled *staccato* and not too rapidly.

The flame at its base presents a large surface to the air, so that any disturbance of the air sets the flame in active vibration.

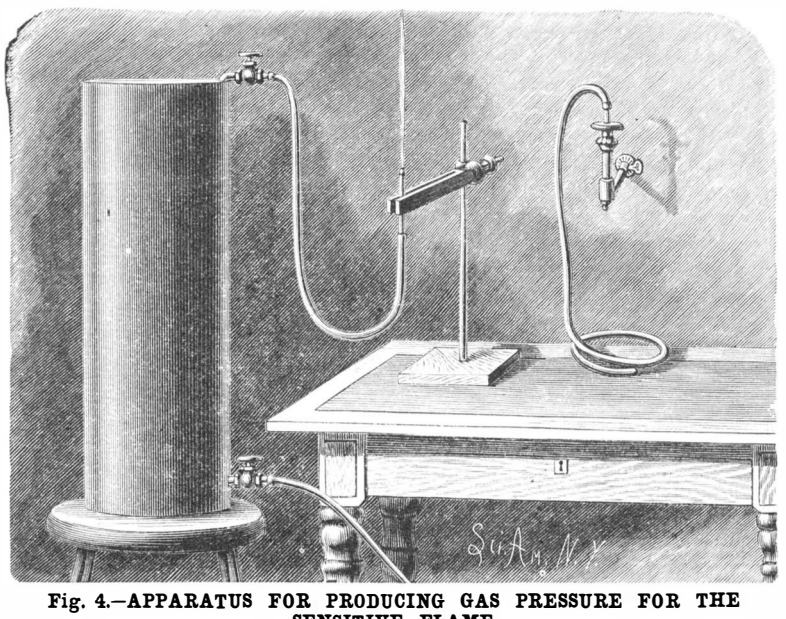
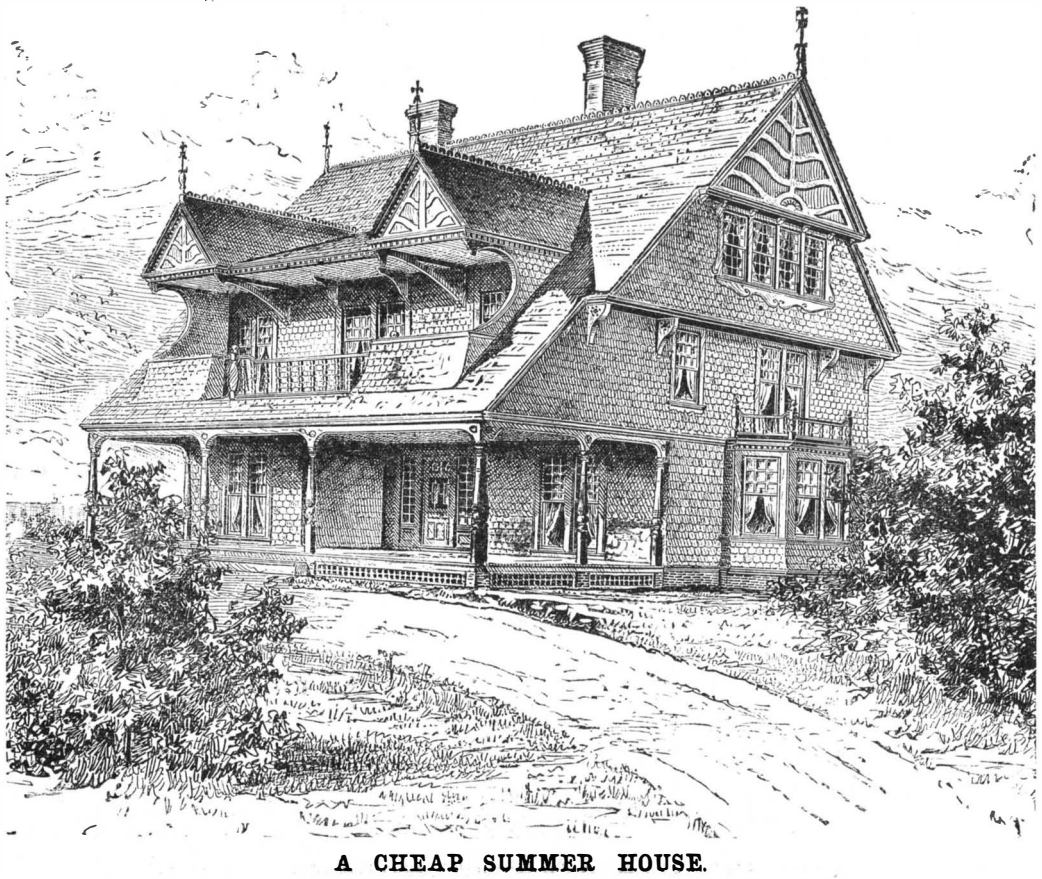


Fig. 4.—APPARATUS FOR PRODUCING GAS PRESSURE FOR THE SENSITIVE FLAME.

A CHEAP SUMMER HOUSE.

This dwelling house has been erected for a seaside residence at Long Branch, N. J., from the designs of Architect W. H. Beers, of New York City. The plans were drawn up with the view of providing commodious rooms to suit the special requirements of the owner. The plans of the first and second floors, with a condensed specification of the materials used in the construction of the house, and the approximate cost of the same, were published in the ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN of April, 1888.



A CHEAP SUMMER HOUSE.

Propagation of Parasites by Water.

The great difficulty in establishing any fixed principles in regard to the detection of micro-organisms in water received an interesting illustration in a recent article in the *Fortnightly Review*. The writer (the Hon. George N. Curzon, M. P.), in giving an account of his visit to Bokhara, dealt incidentally with the question of water supply to that famous city. Mr. Curzon found just the same state of things which prevailed when another Englishman visited Bokhara some 300 years ago. In a population which considerably exceeds 100,000, about every fifth person suffers from the presence of a worm, which is for the most part found in the leg of the individual, between the flesh and the skin. Sometimes a man is troubled with from twenty to thirty of these creatures. The worm, when extracted, is often two or three feet in length, and has the appearance of a long string of vermicelli. But the curious point is that the most minute examination of the drinking water of Bokhara under the microscope has never revealed the presence of the germ of this parasite; nor has Dr. Heyfelden—a devoted scientist, who is attached to the Russian Embassy at Bokhara—succeeded in identifying a male specimen of the creature. He is inclined to think that the female, being oviparous, pushes her way to the surface of the skin when full of young, each *reshta* when dissected being found to contain from half a million to a million embryo worms. The embryos, if occasionally dosed with a drop of water, will live for six days. Beyond all question, the presence of this repulsive worm is due to the filthy state of some of the open pools of Bokhara. The streets abound with dirty tanks of stagnant water. The water in a tank which adjoins a mosque is considered holy, and is used for drinking as well as for washing; thereby spreading the germs of all sorts of diseases, but more especially insuring the propagation of the parasite already described.

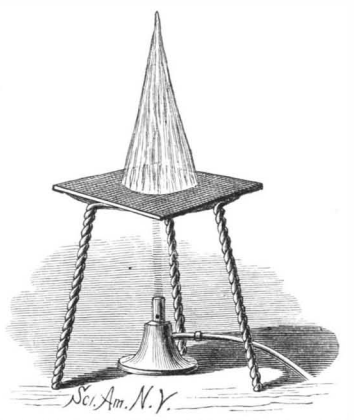


Fig. 5.—SENSITIVE FLAME WITH GAS AT ORDINARY PRESSURE.

Operation on a Lion.

The fine lion Jupiter, at the Clifton Zoological Gardens, Bristol, which is nearly 11 years old, having been cubbed in the gardens in the year 1878, was noticed lately to have a claw on the left fore paw growing into the flesh of its foot, which was gradually laming the animal. The lion was evidently in pain, and it was deemed advisable to remove the claw. The novel operation was performed recently, when a close traveling cage was introduced into the den, and placed against one of the sliding traps in the partition. The animal having been induced to enter the cage, it was removed to the floor of the building and another cage, but of different construction, composed solely of iron bars, placed endways to the door of the first cage, and the two firmly lashed together. After some little trouble the animal was got into the second cage, which was so narrow as not to admit of his turning round. Heavy inch and a half planks were then inserted between the bars, and the lion tightly wedged in. Up to this point he had submitted quietly, but on the introduction of the planks he splintered them up as easily as though they had been matchwood. At last he was firmly wedged in, and a little time was given him to cool down. A favorable opportunity for the operation occurred in a few minutes, his paw being partly through the bars. The head keeper, Blunsden, who was waiting with a pair of powerful nippers, seized the opportunity, and the offending claw was promptly removed. The operation, which was conducted by Dr. Harrison, treasurer of the gardens, was absolutely necessary, as the claw had already grown more than half an inch into the foot, and would probably have killed the animal.—*London Times*.

Sending Threatening Notices.

It has long been the custom for rich men who own patents to drive smaller manufacturers out of competition by advertising constant threats of proceedings against them and those who use their wares, and there can be no doubt that in very many instances rival manufacturers have succumbed to this sort of threat, even when they have known perfectly well that the threatening party had neither right nor justice on his side; and as advertised threats of proceedings are very common in relation to photographic patents, a recent case has special interest for photographers.

The London *Photographic News* reports a flagrant case of this kind in which the court promptly granted relief—Colley *vs.* Hart—of which the following is a summary:

The defendant had for some years carried on a business for the sale of paper for a toilet requisite, and of the appliances on which the same was rolled. In October, 1884, the plaintiff, who had previously carried on a similar business of his own, sold his business to the defendant and entered into the defendant's business as manager. In 1885 a patent was granted to the plaintiff and defendant for "improvements in apparatus for unreeling, perforating, and rereeling papers into rolls for toilet and other purposes," which invention was discovered by the plaintiff, but was worked with other patents for the joint benefit of the plaintiff and defendant. In May, 1888, the business connection between the plaintiff and defendant was discontinued, and the plaintiff soon afterward commenced manufacturing and selling "toilet requisite paper" on his own account. He sold to the firms to which the defendant had been in the habit of selling. In September, 1888, the defendant issued the following circular, stating among other things, in reference to the plaintiff: "His proceedings are a distinct breach of my rights under both patent and trade mark, and I think it right to inform you I intend to commence proceedings forthwith against every person whom I find in any way dealing in any perforated toilet paper manufactured in breach of my patent rights."

In consequence of this circular a number of the plaintiff's customers declined to continue business with him until the matter was settled, and his business was practically stopped. The plaintiff moved for an interlocutory injunction on October 10, 1888, before the vacation judge, who ordered the motion to stand over till the second motion day in the following term, each party undertaking not to issue any circular. Mr. Young, a mechanical engineer, deposed that the manufacture of rolls of perforated toilet paper by the plaintiff did not in any way infringe the defendant's patent. Justice North said: "I shall restrain the defendant from issuing the particular circular and from threatening any person; and from, by means of circulars, letters, or otherwise, 'threatening any person with proceedings or liability in respect of the following papers,' whatever they are, 'manufactured by the plaintiff.'"

Motive Power at the Paris Exhibition, 1889.

The organization of the machinery and motive power department of the forthcoming exhibition is now practically completed. All the machinery will be collected in the enormous hall known as the "Palais de Machines," which covers about 46,000 square meters of ground. The greater portion of this area will be occupied by the French section, and for the foreign sections the spaces reserved are approximately: Great Britain, 4,000; Belgium, 3,500; United States, 2,700; and Switzerland, 2,200 square meters. The exhibits in the main hall will be arranged in six rows parallel with the longitudinal axis of the building. Four of these rows are to be 15 meters wide, and two 10 meters. There will be four lines of main shafting, one to each of the four large rows. Steam will be supplied by a variety of boilers, all of which will be placed in one of the courts, so that the visitor may conveniently compare the different types of steam generators. The total power of the boilers is estimated at about forty tons of feed water evaporated per hour. The following firms are among the exhibitors in the boiler department: Belleville, De Mayer, Knap (London), Babcock & Wilcox (Glasgow), Davey Paxman (Colchester), Wehyer & Richmond, Fives-Lille, Dayde & Pille, Roser, and Dulac. The distribution of steam to the various engines will be effected by underground steam pipes laid in conduits throughout the length of the main building. The size of the pipes is calculated so as to give a maximum velocity of flow of 33 ft. per second. Various boiler pressures will be used, but in the majority of cases the pressure will be between 90 lb. and 120 lb. per square inch. To provide for the condensing engines, there will be two water mains running parallel with the steam pipes, and both 2 ft. diameter—one for the cold water service bringing the water to the condensers, and the other for the return of the warm water. The administration pays the exhibitors of boilers, who supply steam for the general service, at the rate of 8,500 fr. (£340) per ton of steam delivered per hour during seven hours per day, and 180 working days. Should steam be required for a longer time than seven hours daily, the administration makes a further payment of 6 fr. for each ton of steam; and if the exhibition should be prolonged beyond the 180 days, the payment will be 5 fr. for each ton of steam supplied. Taking an average of 26 lb. of steam per h. p. hour, it will be seen from the above figures that the administration pays at the rate of about ¾d. per h. p. hour.

Of steam engines there will be shown a great variety, and the following are among the more important firms exhibiting in the motive power department: Societe d'Anzin, Davey Paxman, Societe le Phenix, Societe de fabrication des locomotives et des machines de Winterthur, Societe d'Oerlikon, Andre Berger de Thaun, Societe alsacienne de constructions mecaniques de Mulhouse, Le Creusot, Fives-Lille, Thomas Powell, Lecouteux et Garnier, Societe francaise de materiel agricole de Vierzon, Bietrix, Boulet, Wehyer et Richemond, and Cail. The so-called "machine Casse," made by the Fives-Lille Company, will be the only example of the beam engine. This will be of 600 h. p. The administration pays 40 fr. per h. p. supplied during the whole time the exhibition is open, viz., seven hours per day for 180 days, and if the power is required after this period, the payment will be ½d. per h. p. hour. The four lines of shafting will be supported on bearings fixed to a system of standards, cross girders, and longitudinal girders, the latter also serving as supports for the traveling platforms, which will run the whole length of the main hall. These will be electrically worked, and used as travelers during the instalment of the exhibits, and later on for the convenience of visitors, who will thus be carried from one end of the machinery hall to the other. The supply of feed and condensing water for a plant of boilers and engines representing about 4,000 h. p. is a matter of some importance. The total quantity of water required per day is estimated at 6,000 tons, or 850 tons per hour. The water will be pumped from the Seine and stored in elevated tanks of 166 tons capacity, the pumping plant being in duplicate, one by MM. Quilacq & Meunier (Wheelock engine), and the other by M. Thos. Powell, Rouen (Worthington steam pumps). The water will be carried to the machinery gallery by a main of 2 ft. diameter, placed along the Avenue Suffren. The exhibition opens May 5.—*Industries.*

The Law as to Party Walls.

A party wall in law is the wall dividing lands of different proprietors, used in common for the support of structures on both sides. At common law an owner who erects a wall for his own buildings which is capable of being used by an adjoining proprietor, cannot compel such proprietor, when he shall build next to it, to pay for any portion of the cost of such wall. On the other hand, the adjoining proprietor has no right to make any use of such wall without consent of the owner, and the consequence may be the erection of two walls side by side, when one would answer all purposes.

This convenience is often secured by an agreement to erect a wall for common use, one-half on each other's land, the parties to divide the expense. If only one is to build at the time, he gets a return from the other party of half what it costs him. Under such an agreement each has an easement in the land of the other while the wall stands, and this accompanies the title in sales and descent. But if the wall is destroyed by decay or accident, the easement is gone, unless such contingency is provided for by a deed.

Repairs to party walls are to be borne equally; but if one has occasion to strengthen or improve them for a more extensive building than at first contemplated, he cannot compel the other to divide the expense with him. In some States there are statutes regulating the rights in party walls, and one may undoubtedly acquire rights, by prescription, on a wall built by another, which he has long been allowed to use for the support of his own structure.—*Building News.*

New System of Propelling Vessels.

According to *Le Genie Civil*, Mr. Gouilly has just communicated to the Society of Civil Engineers a paper on a new system of propelling ships, and which consists in causing the screw to revolve in a sort of a funnel that the inventor calls a collector. This latter is formed of a cylinder, in which the screw revolves, and of a truncated cone, whose narrow end is connected with the cylinder, and whose broad end is directed toward the vessel.

The inventor explains the effects of the collector thus: The collector, applied to the small boat used for the experiments, has the effect of doubling the force of propulsion at the dead point, and of increasing the speed of the boat by one-third. This fact has been confirmed by over a thousand experiments with more than thirty different screws. A large number of experiments have given results in which the force of propulsion was much more than doubled. The collector must not be regarded as a device for improving the motion of the screw, but rather as one which itself co-operates in the propulsion.

In support of this theory, Mr. Gouilly performed before the society four conclusive experiments on a small scale, and with a boat of small size.

Benner's Prophecies.

Samuel Benner, the great financial prophet, in a communication to the *Real Estate Record and Builder's Guide*, published in this city, makes a forecast of the financial and commercial conditions of the country for the coming three years. He reasons from analogy as well as statistics compiled from close observations through many years, and supports his predictions regarding future panics and prices with a philosophic course of reasoning which cannot fail to impress all and convince many. The following is the prophecy in full:

My forecasts at present are not only for the year 1889, but also include 1890 and 1891.

It is a great desideratum to know when good times will commence, and it is also very important to know how long they will continue, and when we may expect the next panic and reaction in general business. The business men of this country do not desire a boom of short duration so much as they do a steady advance in prices and in the developments of trade—continuing for a number of years. However much they may desire this condition for future business, the records of commercial and financial history do not warrant us in making this kind of prophecy.

Since 1825 this country has not experienced a continued advance in the price of iron beyond four years. The resumption of specie payments by the government in 1879 was the occasion for the boom in business following that event. Now we have a decision by the people that protection will continue to be the policy of the government, making the occasion for the turning of the tide from depression to activity in all business. The depression in trade for 1888 was predicted thirteen years ago, and the prediction was also made at that time that the tide would turn, giving us an era of business activity during the years 1889, 1890, and 1891.

The persistence of the repetition of these trade cycles is becoming a commercial wonder, they ride triumphant over all events which have occurred during the past sixty years to oppose such regularity. These cycles have been verifying themselves through the introduction of railroads, steamboats, the electric telegraph, the suspension of specie payments in 1837 and 1857, the panic of 1873, through the Mexican war, our civil war, through all of our presidential terms since the administration of Jackson up, and up to the present time override and defeat the aims of the present administration, while using the whole machinery of the government for re-election, with the avowed policy of a low tariff, which would depress our industries.

What else can a reasonable person ask to prevent their repetition? Better times and higher prices will prevail for the next three years, and no happening or opposition can prevent them.

The outcome of the presidential election has laid a broad basis for a general recovery of confidence, an element that has been wanting for the past four years, which we have observed by the many idle furnaces, mills, and factories, and the lowest prices for nails, steel rails, and pig iron for a number of years.

The year 1889 opens with cheerful hopes. Our crops during the past year have been abundant; the prospects of an increased foreign demand for our surplus grain and provisions at advanced prices give the farmers renewed energy. We must look forward to a hot and dry summer this year, as we are not yet beyond the period for a general drought; however, with fair early crops business and prices will show considerable improvement in the spring months.

We are at the beginning of a prosperous period, and the outlook is for a decided improvement and advance in the prices of iron, railroad stocks, and in all manufactured commodities. Whenever our manufacturers are prosperous, every industrial class is prosperous.

I predict that the price of iron will advance, and the average price for the year 1889 will be higher than the average for 1888; and I also predict that there will be a wonderful advance in prices for iron, stocks, and all products and commodities in the year 1890; all business will be prosperous, it will be a year of good crops and the boom year in this period of activity.

In the beginning of the year 1891 speculation will be at its height—a great business inflation—pig iron $50 per ton in the markets of our country. I predict that there will be a panic in the year 1891. The over-trading and general inflation of business and expansion of credit and confidence will produce this result. The panic probably will be brought about by the effects of heavy rainfalls and floods, or by the collapse of some large financial business firm. This panic will be a commercial and financial revulsion, and will be followed by a long down-sweep of prices.

New Method of Preparing Hydrogen.

Mr. Stolba obtains a mixture of hydrogen and steam by heating lime water and iron filings to a high temperature. It takes but 150 grains of iron and as much lime to obtain 75 cubic inches of gas in 20 or 30 minutes. If it is desired that the hydrogen thus obtained shall be free from hydrocarburets, the presence of carbonate of lime should be avoided.—*Le Genie Civil.*

Correspondence.

How to Make the Hair Grow.

To the Editor of the Scientific American:

Experience has taught me that it is best to keep all oils or grease from the hair. Don't let barbers oil it. I find wetting with water best. At least once a week rub the yolk of an egg, or half of it, well into the hair and scalp, and rinse off thoroughly with tepid water. It will promote growth and color, probably largely due to the sulphur in the egg. This course has started a new growth of hair with me, not very thick, but better than none at all. A.

Lansing, Mich., February 26, 1889.

Petrifying Springs.

To the Editor of the Scientific American:

There is a well known petrifying stream of water at Knaresborough, Yorkshire, England, three miles from Harrowgate, the well known sanitarium. It is a cascade from the River Nidd, about 15 feet high and twice as broad, and forms an aqueous curtain to a cave known as Mother Shipton's Cave. The dripping waters are used for the purpose of petrifying anything sent to be hung up in the drip of the water ledge, which flows over, as it were, the eaves of the cave. This ledge of limestone rock is augmented unceasingly by the action of the waters which flow over it. This cascade has an endless variety of objects hung up by short lengths of wire to be petrified by the water trickling over them, as sponges, books, gloves, kerchiefs and veils, hunter's cap, fox, cat, dog, birds, boots, etc., just as fancy prompts people to seek petrifying results. A sponge is petrified in a few months, a book or cap in a year or two, cat or bird a little longer.

A museum of many interesting things is to be seen in the house of the custodian of the Mother Shipton Cave. The things petrified are mostly larger and somewhat misshapen by the gravitation of the silicate, making the mass larger on the under side of the suspension in the cascade. A cat, for instance, has the legs nearly joined and larger in proportion than the body. One cat shown in the museum had the head broken off at the neck, showing the whole was limestone throughout, with not a trace of the organic structure of the original cat. A glove became like a hand. A book of sermons, a block of stone, from which science may read its sermons through without printing or leaves. When looking at this cascade as an artist, I could not help thinking of the poor old woman who lived before her time, and who was spared from the fate of many thousands of human beings called witches, who have been burned by the ignorant mob or legally by the state officials, mostly at the instigation of the priesthood. It would be a fitting place for a statue of the historic personage —whose prophecies are one by one being verified—to be seated within the cave looking out through the veil of dripping waters on the visitors to the cave, and as fitting inscription in front, the words from a modern poet might be written:

> "All things are sacred in their time and sphere!
> Naught can escape the action of this fact,
> Nor fail to yield an essence, growth, and share,
> Through media with affinities to act."
>
> —*The Epic of a Day.*

I have a human head petrified, but by what action I do not know. It was found in digging a trench through gravel in the park at Bulstrode, in Buckinghamshire, England.

The subject of petrifaction is highly interesting, and deserves careful investigation. I believe many specimens of prehistoric tools, as well as organic remains, might be recovered from the earth if geologists were qualified to judge of tools by external formation. Geologists, unfortunately, are too often only book and stone students, and not capable of judging by appearance of a petrified tool as a bit of stone only or not.

I. CHARLES KING.

22 Grove St., N. W., London.

Paint the Shingles.

The *Timberman* very wisely remarks that it has always seemed singular that in the use of paint to preserve wood exposed to the weather, the fact that a shingle roof was omitted from the catalogue was invariably the rule. This idea or oversight was one of those things in which custom becomes habit, and because every one else did so, all the rest followed suit. It is safe to presume that the custom of leaving the shingle roof unpainted originated in its angular form being less exposed to the after effects of rain or snow. A little thought will show the folly of such a conclusion when remembering the frail nature of a shingle and the slight fastening it has. If paint would be useful on any weather-exposed surface, it should certainly be so on a roof. This fact goes without telling, and in the present style of suburban residences the roof receives its share of paint along with the rest of the building, thus at once combining the useful with the beautiful. It is certainly singular that painting of roofs has not always prevailed, and it adds much to the finished character of the building to see the roof painted.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Northern District of Illinois.

SCHLICHT & FIELD COMPANY *vs.* CHICAGO SEWING MACHINE COMPANY *et al.*

Blodgett, *J.:*

The first, second, third, fourth, fifth, and seventh claims of patent No. 217,909, issued July 29, 1879, to Frederick W. Smith and James S. Shannon, for an improvement in paper holders, sustained (citing Shannon *vs.* Printing Company, 9 Fed. Rep., 205), and *Held* to be infringed by a letter file having its receiving wires arranged to rock forward instead of backward out of contact with its arched wires.

A change in the position of a part of a machine will not avoid infringement where the part transposed continues to perform the same function as before. (Citing Adams *vs.* Manufacturing Company, 3 Banning & A, 1.)

A party applying for a patent as a joint invention of himself and another should be estopped as against a *bona fide* owner of the patent from defeating it by proof tending to show that he took a false oath or otherwise imposed upon the Patent Office. Having given life to the patent by one oath, he cannot be heard to destroy it by another.

Where two parties work together in the making of an invention, each making suggestions to the other, the invention covered by a joint patent will generally be considered as the result of their joint efforts or contributions.

Executions by Electricity.

The new law of the State of New York for the execution of criminals by electricity in place of hanging is now in force, and the State authorities are engaged in arranging the details of the electrical apparatus that is to be officially employed. The New York *Herald* gives the following particulars of some experiments lately made in connection with the subject:

Half a dozen gentlemen learned in the sciences of electricity and surgery had been deputed by State authority to visit Mr. Thomas A. Edison's famous laboratory at Llewellyn Park, Orange, N. J., and there experiment on various lower animals, with the object of ascertaining at what point of a human body the electrical current can most efficaciously be applied in order to secure instantaneous death without burning or disfiguring the flesh of the victim. Several unlucky dogs and calves and one equine quadruped were, on the 12th inst., sacrificed to science in this manner, and the results attained were regarded as thoroughly satisfactory and as demonstrating conclusively the utility and desirability of the alternating current as a means of producing sudden and painless death, whether applied at the head, the arms, feet, side, spine or any other point of the body.

It was shortly after three o'clock when the experiments commenced. They were conducted in a large shed situated in the rear of the laboratory buildings, and the electric current was conveyed by wires from the main structure. Those present were Dr. Carlos F. MacDonald, of the State Asylum for the Insane at Auburn, Dr. A. D. Rockwell, a leading medical electrician of this city, Dr. Edward Tatum, demonstrator of physiology at the Pennsylvania State University, Harold P. Brown, a well known electrical engineer of this city, and A. E. Kennelly, chief electrician of the Edison laboratory, who represented the "Wizard of Llewellyn."

A large Newfoundland dog was the first victim. Unconscious of its doom, the poor animal willingly submitted to the placing in position of the fatal wires, the end of one being fastened to its right forepaw, while the other was placed in proximity to its brain. Then the strength of the current was measured. All being ready, the circuit was completed, and in an incredibly short space of time the dog was dead. It had taken 600 volts of electricity and sixteen seconds of time to dispatch him. A calf was the next subject. It was carried, kicking lustily, into the spacious operating room and held while the deadly wires were arranged, this time at the base of the brain and near the heart. In fifteen seconds from the completion of the circuit the victim was veal. A big mongrel dog, which had been selected for the succeeding sacrifice, seemed somewhat suspicious of the assemblage and declined to approach the wires. He was dragged into position and stood shivering as if cognizant of his rapidly approaching fate. A wire was affixed to his hind leg, another placed over his heart, and in less time than it takes to tell it the poor beast's anticipatory terrors were over.

It was decided to offer up the horse next, and he was accordingly led in and prepared for the slaughter. He looked a despondent, played-out sort of quadruped, and if he knew what awaited him, he certainly did not object. The same wires, several hundred volts and a few fleeting seconds led to his utterly painless demise, and his carcass was dragged aside to make room for more calves and canines. Two medium sized mongrels died for science, and three more innocent calves were butchered in a far more expeditious manner that in vogue at the shambles. By that time the experimenting party had solved any doubts that may have previously existed in their minds regarding the certainty of quick death by the alternating current, and had gathered sufficient material upon which to base an opinion as to the best points for application of the current. So they abandoned the roles of executioners and turned their faces homeward.

Mr. Harold P. Brown and Mr. A. E. Kennelly said the results attained could not have been more satisfactory, but of course, not having yet discussed the subject, they could not publicly advance an opinion on the greater eligibility of one portion of the body than another for the application of the current. Death, painless and speedy, had resulted in every instance. The force of the current used varied from five hundred to one thousand volts, alternating from two hundred and eighty to three hundred per second, thus emphatically disproving the contention advanced by certain advocates of the continuous current that one thousand volts of the alternating current would prove comparatively harmless, and that considerably over one thousand volts would be necessary to insure death. The time occupied had varied from ten seconds in the case of one dog to twenty-five seconds. As for the bodies of the slain, they so completely escaped disfigurement that the veal was perfectly suitable for human food, and it was returned to the butcher who had brought the calves to the laboratory.

New Process of Hardening Plaster of Paris.

The French Academy of Sciences, says *La Semaine des Constructeurs*, has just received a communication from Mr. Julte on a new process of hardening plaster so as to adapt it to the construction of flooring in place of wood, and to other purposes for which it cannot be used in its ordinary state on account of its want of hardness and resistance to crushing.

Mr. Julte recommends the intimate mixture of six parts of plaster of good quality with one part of finely sifted, recently slaked white lime. This mixture is employed like ordinary plaster. After it has become thoroughly dry, the object manufactured from it is saturated with a solution of any sulphate whatever whose base is precipitated in an insoluble form by lime. The sulphates best adapted for the purpose, from every point of view, are those of iron and zinc.

With sulphate of zinc, the object remains white, as might be supposed. With sulphate of iron, the object, at first greenish, finally assumes, through desiccation, the characteristic tint of the sesquioxide of iron. The hardest surfaces are obtained with iron, and the resistance to breakage is twenty times greater than that of ordinary plaster. In order to obtain a maximum of hardness and tenacity, it is necessary to temper the limed plaster well in as brief a space of time as possible, and with no more water than is strictly necessary. The object to be hardened should be very dry, so that the solution employed may penetrate it easily. The solution should be near the point of saturation, and the first immersion should not exceed two hours. If immersed too long, the plaster would become friable.

The proportions of the lime and plaster are arbitrary, and may be varied according to the results to be obtained; nevertheless, the proportions of one to six have given the best results.

As it is important that the plaster should not be spread over the surface by passing and repassing the trowel for too long a time, the fastest workman will always be the best one to employ. When sulphate of iron is used, the slabs are of the color of iron rust; but if linseed oil boiled with litharge be passed over the surface, they assume a beautiful mahogany color, and offer a certain superficial elasticity to the tread. If a coat of hard copal varnish be added, the color becomes very beautiful.

On spreading a two or three inch layer of limed plaster in a room, and treating it in the way above described, we obtain a floor which is as smooth as a mirror, and which, in most cases, fulfills the office of an oak floor, but which has the advantage over the latter of costing four times less.

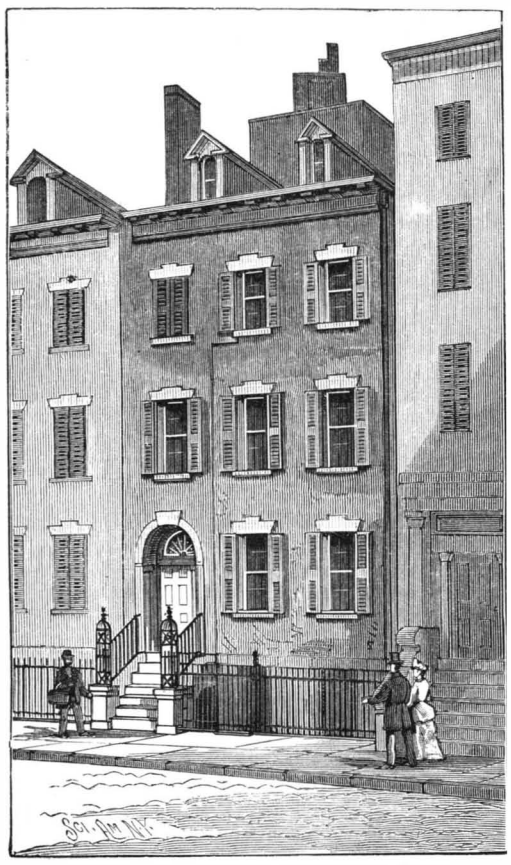
Acrophobia.

Among the many curious psychical experiences that are now attracting attention, the one to which the term "acrophobia" has been applied has many points of interest. It refers to an exaggerated condition of fear when in high places. Dr. Verga has recently described the phenomena in his own case. Though by nature not at all timid, all his courage leaves him when above ground. He has palpitations in mounting a step ladder; finds it extremely unpleasant to ride on top of a coach, or even to look out of a first story window. His idiosyncrasy forbids him to use an elevator, and the mere thought of those who have cast themselves down from high places causes tingling all over his person. The thought of the earth spinning through space is enough to cause discomfort. He finds this fear growing upon him as sight and hearing become less acute, and what walking in high places was formerly possible for him is getting more and more difficult. A greater or less degree of this fear is undoubtedly quite common. A very intense form of it seems perfectly consistent with normal functions.—*The Polyclinic.*

THE LATE CAPT. ERICSSON AND HIS WORK.

(*Continued from first page.*)

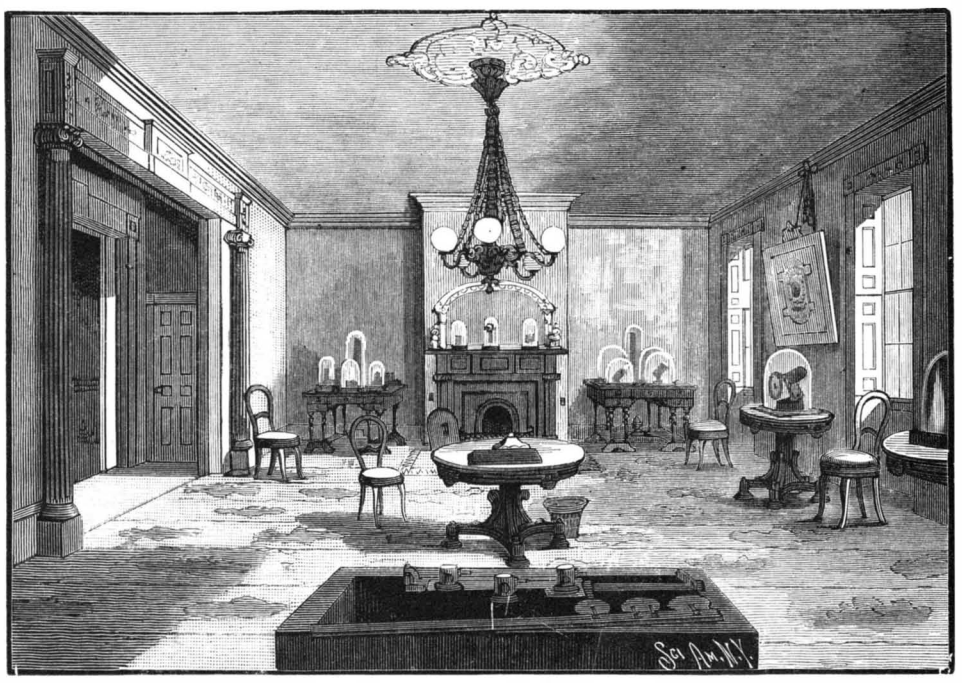
mode of its practical application, tending to hasten the day of its final adoption. He illustrated his ideas by the construction of a boat, 40 ft. by 8 ft., with two propellers, and we give herewith an illustration of this boat towing the barge of the Lords of the Admiralty on the Thames, in 1837. The rejection of his plans by the Admiralty, for the reason that "a boat propelled from the stern could not be steered," is said to have been the principal reason why Ericsson, chagrined and disappointed, determined to come to America. To this course he was largely persuaded by Commodore Stockton, of the U. S. navy, who secured his services afterward in the construction of the U. S. steam frigate Princeton, a vessel at the time considered by high naval authorities the best specimen of a war ship afloat.



HOUSE IN WHICH ERICSSON DIED.

The very next year after his arrival in America, Ericsson received the gold medal of the Mechanics' Institute, of New York, for a steam fire engine, which affords the subject of one of our illustrations. He had previously, however, made a practical demonstration of his acquaintance with this subject by building a steam fire engine that did valuable work in extinguishing a fire in London in 1829. From this time up to 1851, the inventor gave much attention to the development of his caloric engine. In the latter year a vessel made a trip from New York to Washington propelled by this motor, but it failed to come up to the ideas of the inventor in the development of large powers, and he thereafter withdrew it from the field of marine engineering.

Capt. Ericsson had already been a most busy worker for half a hundred years on subjects connected with scientific, mechanical, and engineering matters when the war for the Union broke out. It is easy to see how, after the years of study and costly experiment he had devoted to almost all branches of naval engineering, and for which he had received such inadequate appreciation, his mind at once grasped the great possibilities presented by the emergencies of the situation. When, therefore, the Navy Department at Washington advertised for plans for iron-clad steam batteries, the efficiency of which was then considered highly theoretical, he speaks of it as a subject which he had "thoroughly considered for years," and he "was fully prepared to present plans of an impregnable steam battery of light draught, suitable to navigate the shallow rivers and harbors of the Confederate States."



PARLOR CONTAINING HIS MODELS.

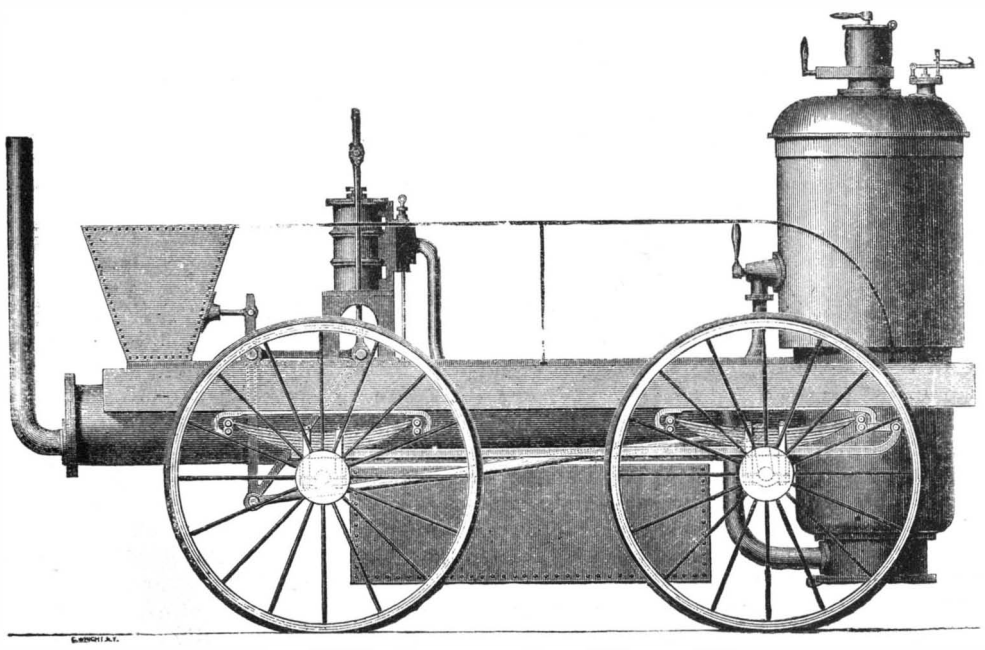
It would, obviously, be superfluous, in this place, to make any detailed reference to that memorable naval conflict between the Monitor and Merrimac at Hampton Roads, in the spring of 1862, which affords the subject of one of our illustrations. We have not yet seen the end of the revolution in methods of naval warfare which that conflict inaugurated. And as we now look upon the plans and drawings representing this diminutive and unpretending little gunboat, by the side of those called for by the great modern war ship, the comparison is the more impressive when we consider the years through which the engineer and inventor worked, without encouragement or outside countenance, to bring facts and principles now so well understood before the public.

TRIAL OF HIS PROPELLER ON THE THAMES IN 1837.

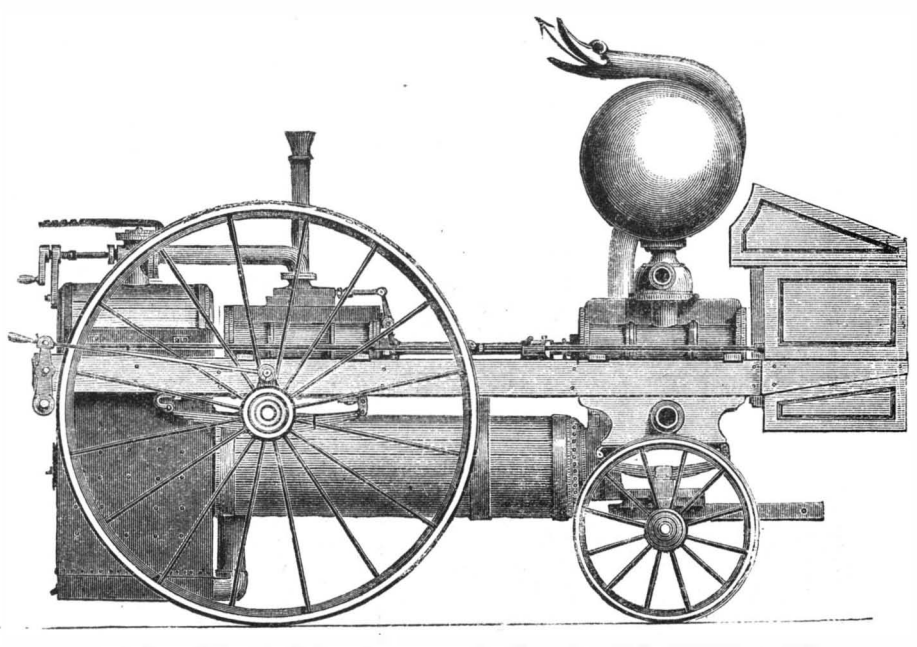
The plans of Captain Ericsson were not accepted by the Naval Board without a good deal of difficulty; but when once the direct authorization to build the Monitor had been made, he proceeded with the work with his usual energy and clearness of foresight. He divided the work among three leading establishments, with instructions that only the most skillful men should be employed, and the work continued at night whenever practicable. Each establishment was furnished with detailed drawings of every part of the structure, and so exact were these drawings, that every part sent on board fitted the place for which it was intended, and this novel craft, with battery and steam machinery complete, was launched in one hundred days from laying the keel plate.

During and after the war, Captain Ericsson continued to give great attention to the perfection of plans for subsequent Monitors adapted for sea-going, and in the latter part of 1878 his Destroyer, which forms the subject of two of our illustrations, was launched from the Delamater iron works. This is an iron vessel, 130 feet long, 17 feet wide, 11 feet deep, protected by a wrought iron breastwork of great strength near the bow, and adapted to use a submarine gun of 16 inch caliber and 30 feet length, the muzzle projecting through an opening in the stem near the bottom. The intended weight of the projectile is 1,500 pounds, including an explosive charge of 300 pounds of gun cotton. This boat is intended to supersede more costly steam war vessels, to attack bow on, and to discharge its projectile at a distance of only 300 feet from the vessel attacked. The narrow beam, almost total submergence, and great speed to be obtained in these boats would make it difficult for a great ironclad to surely guard against their approach, while it is claimed that nettings could not stop the progress of such a projectile, and armor plates two feet thick would be no protection from the shattering effects of such an explosion of gun cotton as the gun is designed to carry. In 1885, the Senate passed a bill for the purchase of the Destroyer for the United States navy, but the bill failed to become a law. The Destroyer now lies at the Brooklyn navy yard. It is said that 40 boats of this type could be built in New York City inside of 90 days, should the emergency arise calling for their use for harbor protection.

During all the later years of his life Captain Ericsson gave much attention to the production of a solar engine, making many experimental trials, but this work



LOCOMOTIVE BUILT IN ENGLAND IN 1829.

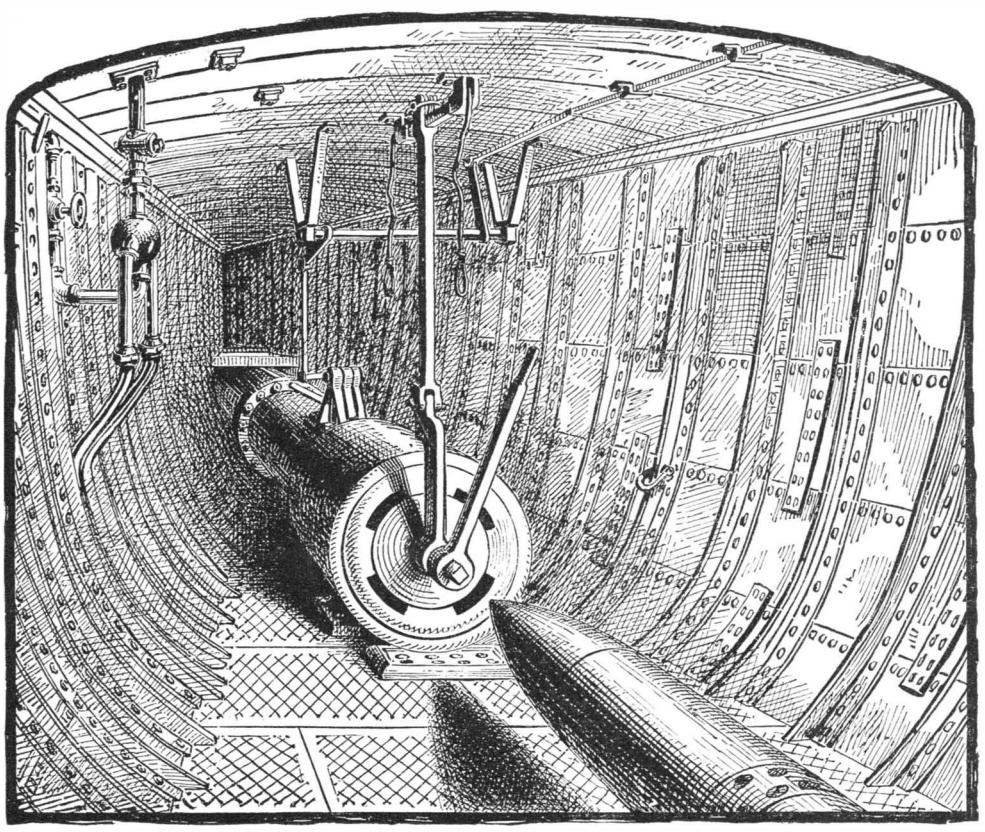


FIRE ENGINE FOR WHICH HE RECEIVED GOLD MEDAL FROM MECHANICS' INSTITUTE, NEW YORK.

was in continuation of the studies of his lifetime, in which he has principally sought to develop the theory that "heat is an agent which undergoes no change, and that only a small portion of it disappears in exerting the mechanical force developed by our steam engines." The idea has not yet been pushed to a successful solution, but in a paper published by him in 1884 he states that, with reflecting plates of 130 by 180 inches, and a steam cylinder 6 by 8 inches, he obtained a speed of engine of 120 turns per minute, with an absolute pressure on the working piston of 35 pounds per square inch. It seems quite probable that studies and experiments in connection with this sun motor occupied almost the exclusive attention of the great inventor during his last days.

The house in Beach Street, New York City, where Captain Ericsson died, and where he had lived for more than twenty years, forms the subject of three of our illustrations, one view representing the back parlor on the first floor. His workshop was the front room on the second floor, facing the great freight depot, which took the place of a beautiful park that existed there when he first took up his abode here. During his last years he was very careful of his time, having two assistants at his work, Messrs. Samuel W. Taylor and Valdemar F. Lassoe, who also carefully guarded him from the annoyance of intruders. It is said that he used to rise at seven o'clock in the morning all the year round. Exercising and bathing occupied the next two hours, and then he breakfasted, generally on dried brown bread prepared after a receipt of his own, two or three poached eggs, and tea with plenty of milk. He dined at four, the meal consisting of vegetables, tea, and bread, with not more than an ounce of meat. He took no other meal. He did not use tobacco nor drink wine, beer, or spirits, because he thought they were not good for him. He worked in his shop as a rule from ten or half-past ten A. M. to four P. M., and from about six to eleven o'clock in the evening, often taking his only outdoor exercise by long walks after the latter hour.

The funeral, from Trinity Church, March 11, called together an audience of citizens of distinction such as is rarely brought together, to do honor to the memory of one who had become great as an engineer and inventor. There were present delegations from the Mechanical Engineers' Society, the Union League Club, the Navy Yard, the Swedish Society, and the workmen of the Delamater Iron Works, large numbers of whom failed to gain admittance to the church.



INTERIOR OF THE DESTROYER, LOOKING TOWARD THE BOW.

The inventor received many honors from his native country, where he was held in high regard by the people as well as by the government officials. The picture which heads our illustrations represents a monument erected in 1867 to mark his birthplace, a cottage now occupied by an inspector of local mines. It is a simple granite shaft, eighteen feet high, and weighing eighty thousand pounds. On the day of its dedication work was suspended in the mines and iron furnaces, and workmen gathered from all the surrounding country to make a gala day of the event.

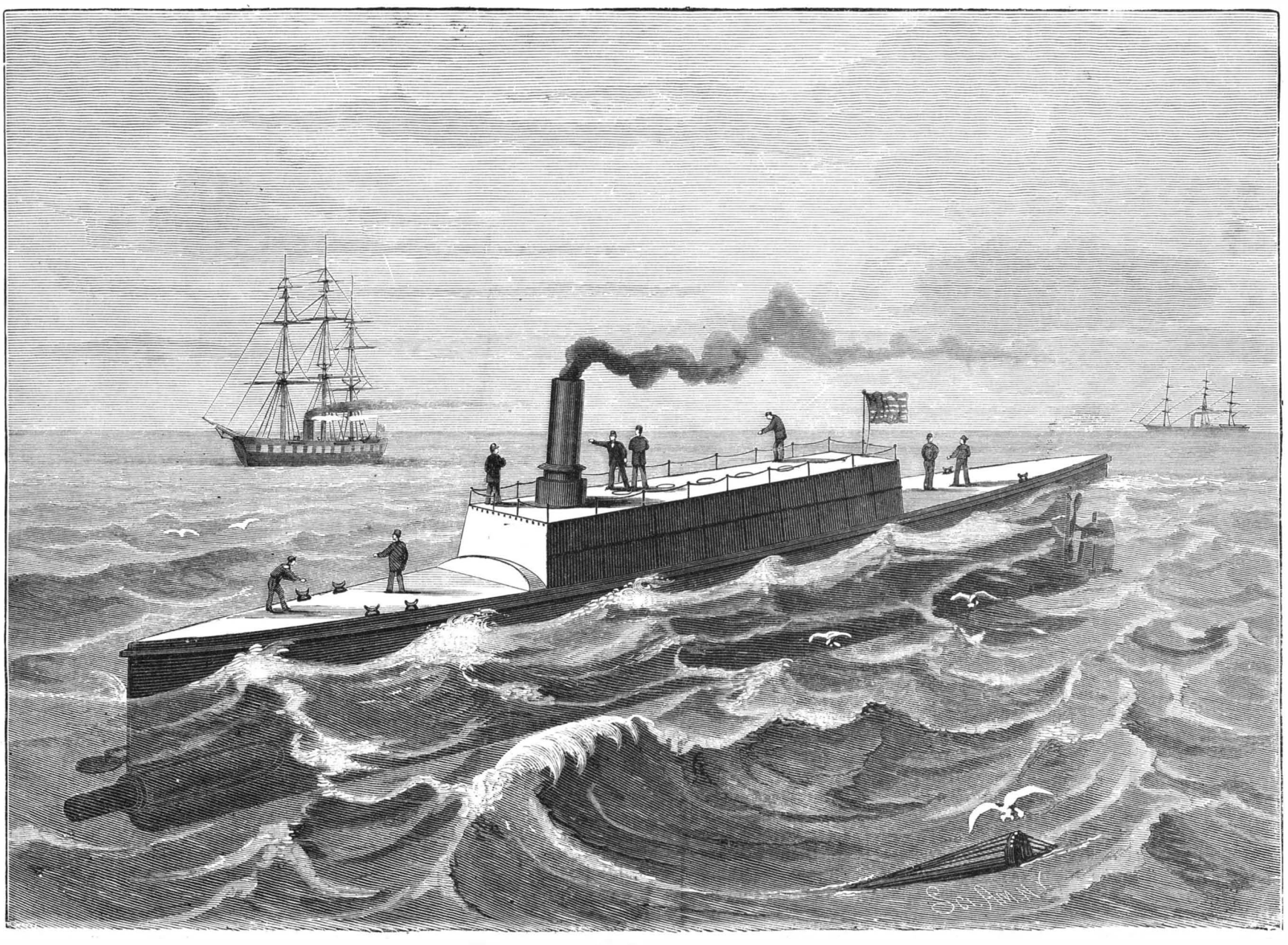
We are indebted to Col. W. C. Church and the Century Co. for some of the facts and several of the illustrations in this article.

A Mile a Minute and Faster than the Wind.

There has been splendid ice boating from Carthage Landing to Fishkill for several days on the flats, and a rattling race was sailed there recently. The course was two miles and a half from Carthage Landing to a turning stake and return. The wind was blowing strong west-southwest (velocity probably 25 miles per hour) and the ice was in splendid condition.

The starting boats were the Ranger, owned by Merritt Bros., B. W. Van Voorhees, owned by Mr. Pinkney, and the North Star, owned by Mr. Isaac Miller. The judge and starter was Robert Dunwoody. Quite a number of people witnessed the contest. The three boats got away evenly, and bore away east of south, the Ranger taking the lead right away, followed closely by the Van Voorhees, North Star being a close third. It was a lifting breeze for the two latter, but the Ranger, being a lateen, stayed down to her work, and made the turn ten seconds ahead of the Van Voorhees, North Star rounding third, five seconds later. On the run up the river, the New York express train due here at 1:58 P. M. was passed by the Ranger at lightning speed almost, the Ranger beating the Van Voorhees in handily, all three boats making the race in the following order: Ranger, 5 minutes; B. W. Van Voorhees, 5:20; North Star, 5:22.—*Poughkeepsie Eagle.*

A RECENT writer says that those nations which are given to the cultivation of vocal music are strong and vigorous, with broad, expansive chests. Vocal music is a good lung exercise; it increases expansion of the lung tissue; it calls into action the entire lung, thus making the apices less likely to develop organic disease. —*Dr. Busey, Virginia Medical Monthly.*



THE TORPEDO BOAT DESTROYER AT SEA.

Natural History Notes.

The Voice of the Lark.—Mr. J. S. Wood says, in the *Naturalist:* "The lark ascends until it looks no larger than a midge, and can with difficulty be seen by the unaided eye, and yet every note will be clearly audible to persons who are fully half a mile from the nest over which the bird utters its song. Moreover, it never ceases to sing for a moment—a feat which seems wonderful to us human beings, who find that a song of six or seven minutes in length, though interspersed with rests and pauses, is more than trying. Even a practiced public speaker, though he can pause at the end of each sentence, finds the applause of the audience a very welcome relief. Moreover, the singer and speaker need to use no exertion, save exercising their voices. Yet the bird will pour out a continuous song of nearly twenty minutes in length, and all the time has to support itself in the air by the continuous use of its wings."

The Age of Animals.—Mr. Pouchet publishes in the *Siecle* the following reflections upon the age of animals: This question, except for domestic animals, is somewhat obscure, and is full of difficulties. The example of the elephant that the Jardin des Plantes has just lost proves nothing. The animal, as well known, died of phthisis at the age of about forty years, and in the prime of life.

We know of no rule that permits of conjecturing, outside of direct experience, the length of animals' lives. The stature, which regulates in so precise a manner the length of gestation (which is so much the longer in proportion as the animal is larger), furnishes no clew to the duration of life. The horse, which surpasses man in bulk, lives to a much less age, and the same is the case with the dog and the other domestic animals. Is this a consequence of the conditions of artificial existence in which they are kept by man? This does not seem very probable, but, on another hand, we have no idea that permits us to form conjectures, even, as to the age that animals may reach in a wild state. What appears probable is that each carries in itself the faculty of living for a period of time sensibly equal (aside from accident) to that of the other animals of its species—a time that varies with each one in particular, but without there being anything that can teach us in advance upon this point. At all events, man and the warm blooded quadrupeds, even the elephant, seem in this respect far from being the best favored.

As regards insects, we are much better informed. Many butterflies see but a single spring. The egg hatches, the caterpillar develops, the butterfly takes wings, couples, lays eggs, and dies. The egg passes through the winter, and in the following year gives a new generation, which will live neither a longer nor a shorter length of time.

The Cunning of Swallows.—Birds are often said to possess instinct, as distinguished from intelligence, by which is meant, apparently, that such knowledge as they have is inherited, not acquired. "A bird always builds its nest in one way," it is said, but few statements could be less exact.

Our common cliff swallow, known also as the eaves swallow and the "Republican," formerly built against the face of a cliff, and as a protection against the weather, the nest, instead of being open at the top, was bottle shaped, the entrance being through a kind of neck at the side. Now that the country has become populous, however, this swallow has taken to nestling under the eaves of barns, where it is shielded from rain by the overhanging roof.

Little by little, therefore, the wise bird has given up its more elaborate method of construction, till now you may see, side by side, nests that are simple mud saucers, nests that are built in the old fashioned bottle method, and nests half way between the two extremes, showing plainly that a process of adaptation is going on.

A Pennsylvania newspaper lately reported a very clever piece of work by a pair of these same eaves swallows. They had built a nest in the old style under the eaves of a barn, and when it was done an English sparrow took possession.

The swallows made frantic efforts to dislodge the intruder, but could not drive her out. Then they went deliberately to work and plastered up the neck of the bottle with mud, burying the sparrow alive, after which they built another nest close by and occupied it as if nothing had happened.

The Laughing Plant.—Palgrave, in his work on Central and Eastern Arabia, mentions a plant whose seeds produce effects analogous to those of laughing gas. The plant is a native of Arabia. A dwarf variety is found at Kasum, and another variety at Oman, which attains a height of from three to four feet, with woody stems, wide-spreading branches, and light green foliage. The flowers are produced in clusters and are yellow in color. The seed pods contain two or three black seeds of the size and shape of a French bean. Their flavor is a little like that of opium, the taste is sweet, and the odor from them produces a sickening sensation and is slightly offensive. These seeds, when pulverized and taken in small doses, operate upon a person in a very peculiar manner. He begins to laugh loudly and boisterously, and then sings, dances, and cuts up all kinds of fantastic capers. The effect continues about an hour, and the patient is extremely comical. When the excitement ceases, the exhausted individual falls into a deep sleep, which continues for an hour or more, and, when he awakens, he is utterly unconscious that any such demonstrations have been made by him.

Why the Cat is not Harmed by a Fall.—It is quite wonderful to see a cat jump from a height. It never seems to hurt itself, or to get giddy with the fall. It always lands on its feet, and these are so beautifully padded that they seldom or never get broken. Why does not the animal get a headache after its jump? Why does it not receive a concussion of the brain, as a man or a dog would if he performed a similar acrobatic feat? To answer this, we must examine a cat's skull, when we shall see that it has a regular partition wall projecting from its sides, a good way inward, toward the center, so as to prevent the brain from suffering from concussion. This is indeed a beautiful contrivance, and shows an admirable internal structure, made in wonderful conformity with external form and nocturnal habits.

Preserving the Colors of Flowers.—A process of preserving the colors of flowers in dried specimens, as used in Berlin, consists in steeping the plants in a solution of sulphurous acid containing one-fourth of its volume of methylated spirit. Delicate flowers require an immersion of but five or ten minutes, and thick leaves as much as twenty-four hours. They are then removed, the fluid is allowed to evaporate, and the plants are dried between paper in the usual way.

The Hippopotamus, says *Popular Science*, seems destined to become extinct within the next twenty years. So many of the animals have been exterminated by the natives and sportsmen that they are now scarcely to be met with.

The Poison of Eels.—It appears from a communication made to the *Regii Lincei*, at Rome, that eels and murenæ possess a poison similar to that of vipers. In them, it is not found in the mouth, and they have no organ for inoculating their enemies with it. So it is usually without any effect upon man, because in the eel eaten by him as food the poison is destroyed by the heat of cooking, and also because, as is the case with the venom of the viper, it has no effect upon the digestive ways.

The Fur Dog of Mantchooria.—Miss Gordon Cumming has an interesting article in a recent number of *Blackwood's Magazine* on the various uses to which the dog is put among different peoples.

Among other varieties, she describes one which is bred in large numbers in Mantchooria for the sake of its skin and fur. The breeding of this dog on farms devoted to the purpose is carried on just as regularly there as is that of sheep in Australia. The fur of the dog attains its greatest value among the breeders when the animal is eight months old, during the winter succeeding its birth. This is the age at which the animals are killed, only those being preserved that are designed for breeding purposes. The dog farms are found in the vast territories of Northern Mongolia and Mantchooria. There are thousands of them on which hundreds of the animals are raised specially for the market. On most others, the owners are satisfied to raise only the number of dogs necessary to keep up the wardrobe and the supply of carpets for the house. The Mantchoorian race of dogs is certainly the most beautiful one that exists as regards the fineness and silkiness of its coat.

The Weather Plant.—It is a well known fact that a number of plants are more or less sensitive to present or coming atmospheric disturbances, and are consequently called sensitive weather plants. A newly discovered and very sensitive weather plant has been made a subject of special study in relation to weather probabilities by Mr. J. F. Nowack, a chemist, in Bohemia. The plant in question has been observed and tested during the last three years, and has indicated the weather fully two days in advance with surprising accuracy. This plant was originally cultivated from seeds obtained from the tropics, and, according to Professor Weiss, of Prague, its anatomical structure is similar to that of the sensitive tropical Mimosæ (to which it seems to be allied), and its leaves are provided with movable joints to permit of their bending easily in either direction. Professor Weiss finds in the upper sides of the leaves a substance which has not yet been found in other plants, and which is thought to be the actuating force. This substance is at present under observation.

The Effect of Earthquakes upon Animals is discussed by Professor Milne in a recent number of the Proceedings of the Seismological Society of Japan. It is known in a general way that animals exhibit great terror during these phenomena, even fishes taking part in the general alarm. The terrified dogs, cats, horses, and cattle endeavor to get away, knowing full well that something abnormal is taking place. Sometimes, even, they become restless previous to the earthquake. Hogs, dogs, and geese seem to be more sensitive than other animals, and according to the Japanese, moles become exceedingly active before the event. The frogs cease to croak, the horses begin to neigh, and the pheasants screech. This is not because these animals are endowed with any divinatory faculty whatever, but it is probable for the reason that they feel the first slight tremors that habitually precede the heavy shock. The inhabitants of earthquake regions so well know the susceptibility of animals that, since the great earthquake of Calabria, the inhabitants take to flight as soon as a horse neighs or a hen clucks. Sometimes, again, the shocks are preceded by a great mortality among mice, rats, or fish. This is doubtless due to the eruption of poisonous vapors. Among other precursory signs of earthquakes learned from animals, Professor Milne mentions that of the exodus of certain creatures, such as rats and dogs, and the presence of flocks of restless birds.

Classification of Ferns.—As perhaps no species of fern exists which has not, in different classifications, successively belonged to several genera, Mr. G. Colombe, confining himself to French species, has endeavored to find out whether any anatomical characters exist that permit, concurrently with the external morphological ones, of establishing more sharply defined groups. He has found that the most constant characters, and, at the same time, the most easily observed ones, are offered by the form of the transverse section of the wood in the vascular bundles of the stipe, and which, from their peculiar constitution, Mr. Van Tieghem has recently named *stelæ*.

The Ancestors of the Dog.—Mr. M. Boule, in a note to the French Academy on the predecessors of the present Canidæ, shows that, in the Miocene epoch in France, there were animals that offered some affinities with the dogs. In the Quatenary epoch, numerous species are found, and these seem to be identical with the present species. The deposits between the middle Miocene and the Quaternary furnish but a small number of data. Upon studying the remains of dogs taken from the Pliocene formation of Puy-de-Dome and Velay, Mr. Boule has found that, far previous to the Quaternary epoch, the Canidæ offered a large number of species, and that these latter already realized the types of the present wolves, foxes, jackals, and dogs. The *Canis Borbonicus* of Perrier, while offering some affinities with the civets, may be considered as an ancestral form of the foxes. The *Canis Etrascus* was a very near relative of the present wolves. Another species had the dental formula of the cuon. Finally, a jaw from the Pliocene near Puy exhibits the characters of certain races of domestic dogs.

In the presence of such facts as these, it becomes difficult to admit, as has often been done, that all our races of domestic dogs are but artificial modifications of their congeners, the wolves and jackals.

A Mammoth Elevator.

The Canadian Pacific's new grain elevator, just completed at Fort William, on Lake Superior, Elevator B, as it is called to distinguish it from the first elevator built there by the Canadian Pacific Railway Company, has a capacity of 1,400,000 bushels. There are 14 elevating legs, each capable of elevating 7,000 bushels per hour. Each of these legs is furnished with a self-cleaning boot, the invention of W. J. Loss, the company's Superintendent of Buildings. Owing to a provision having to be made for tightening the belt which carries the elevating buckets, there has always been a certain amount of grain remaining in the boot, which requires to be frequently cleaned out by hand, and always so when changing from one grain to another.

This boot has an ingenious arrangement, by which a shield is attached to the frame carrying the pulley. This shield is always just kept clear of the buckets, no matter what position the pulley takes in the boot while tightening the belt from time to time. Grain men will understand the advantages of always having a clean boot to start elevating with.

The whole of these legs are driven by friction clutches attached to the shafting, two lines of which are run the entire length of the elevator. These two lines of shafting are driven by a single massive seven-ply rubber belt 56 inches wide and over 300 feet long. This method was first tried in Elevator B at Montreal, and found to work so satisfactorily that it was decided to accept the same arrangement at Fort William. This elevating machinery, with the steam shovels, will enable a train of 16 cars to be unloaded and stowed away in the bins in twenty minutes.

MR. SYLVESTER BAXTER, lecturing recently at the Old South Church, Boston, on "Berlin," is quoted in *Modern Light and Heat* as saying: "It is the most splendid city on the Continent. It is a model city, and has everything best of its kind. It has the most brilliantly illuminated streets of any city in the world. There are over 10,000 telephones in use. The long distance telephone is being rapidly introduced. There is a pneumatic tube service for delivery of parcels, letters, etc., a great improvement over our special delivery. This, in connection with the telegraph and telephone, is run by the postal service. The city railway is elevated, and a great convenience. The street cars only stop at stated points."

Heart Diseases.

Under the title, "Is the American Heart Wearing Out?" Prof. J. W. Darling, M.D., of the New York Homœopathic Medical College, recently read before the New York State Homœopathic Medical Society a paper which is of considerable interest and value, in view of the numerous deaths attributed to heart failure that have occurred in recent years in this country.

Dr. Darling states that disease of the heart is certainly either more common among us than formerly or else the physician of the past failed to recognize this malady when it did exist. The object of his paper is to fathom the causes of the terrible mortality due to cardiac trouble, to call attention to the indiscretions that give rise to certain forms of the malady, to show how persons suffering from organic heart disease can, by their own unaided efforts, prolong their days, to account for heart failure as the cause of death in many diseases which, without this factor, would be recovered from, and to explain some of the most common forms of heart disease and correct certain misconceptions with regard to them, for it is popularly supposed that there is but one form of heart disease, and that invariably fatal.

At the outset, the author states, as the result of his long experience and special study, that cardiac disease is not necessarily fatal; that many apparently grave forms are entirely recovered from; that enlargement of the heart is not in itself a disease; that with serious valvular disease developed in childhood, patients have been known to live to be aged men and women; and that, with a large majority of those supposed to be suffering from disease of the heart, that organ is, in reality, perfectly sound, and, if affected at all, is suffering secondarily to functional disturbances of organs remote from the heart, and which are capable of proper hygienic measures.

Diseases of the heart may be divided into two general classes: those originating from an inflammatory process within the heart and those originating from without. In addition to these may be mentioned certain nervous affections of the heart which are secondary to disturbances elsewhere, which subside with the removal of the cause.

The first class of cardiac diseases are common to all periods of life; they involve almost exclusively the left side of the heart, and more frequently the mitral valve, and result from an inflammation of the lining membrane, the indocardium. This inflammation is more intense along the edges of the valves, the tips of which subsequently develop a growth of fibrous tissue which causes a permanent deformity of the valve or orifice—"valvular disease of the heart"—the result being a permanent obstruction at that point.

A person suffering from valvular disease is crippled, "but," says Dr. Darling, "if the nutrition of the heart be good, by avoiding indiscretions and adopting an occupation that does not require great physical strain, by living on a level, as it were, life may be prolonged in comfort for many years. All are liable to the diseases producing this form of heart lesion, whether their lives are good or bad, discreet or indiscreet, but not equally liable by any means.

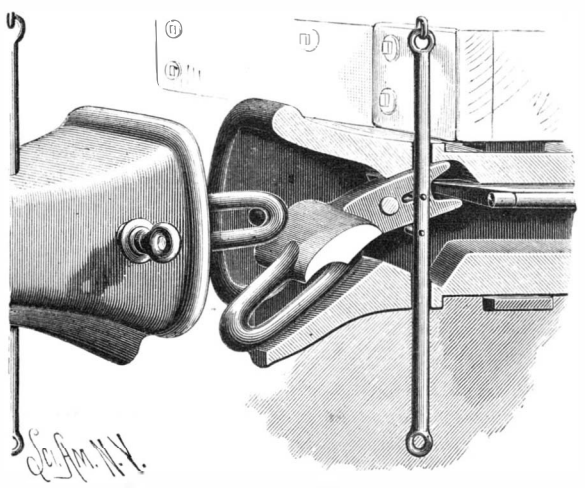
Heart diseases of the second form are, save in exceptional cases, the direct result of hereditary influences or of indiscretions in life, and by proper knowledge and precautions can, in the majority of cases, be avoided; or, if already established, be checked in their progress. The predisposing causes of this form of disease are long continued mental work, and such indiscretions as the habitual use of wine or excess in the eating of food highly charged with nitrogen (such as beef, mutton, and venison), which bring about conditions of the digestive organs, especially of the liver, that result in arterial changes which cause the heart to fail long before it should. The author unhesitatingly asserts that the forms of heart disease which kill so suddenly, and which do not result from endocarditis, or the presence of a specific poison in the blood, arise in nearly every instance directly from the pathological condition known as "gouty diathesis," or lithæmia, due to certain disarrangements of the liver. Conceding that liver disturbance is the primary cause of the premature wearing out of the heart, it is proper to ask: What mode of life will prevent these diseases? and, When they do exist, how shall a life be regulated so as to avoid sudden death, or the rapid failure of that most vital of all organs, the heart? The answer to the first question is simple enough: A discreet life, temperance in all things, and particularly the avoidance of the above mentioned indiscretions, especially the habitual use, even in moderation, of stimulating drinks, and the ingestion of too much meat. In answer to the second question, the author quotes approvingly the three following rules laid down by Dr. George Harley: (1) Take exercise without fatigue, (2) nutrition without stimulation, and (3) amusement without excitement.

Alcohol.

The death rate in the case of brewers, commercial travelers, and other classes exposed to the temptation of frequent alcoholic drinking is six times greater than in all the other industries combined.—*Medical Review.*

AN IMPROVED CAR COUPLING.

A car coupling designed to be automatic in its operation, and adapted to couple with drawheads of different heights, has been patented by Mr. Samuel Byrne, of No. 158 Robert Street, Toronto, Canada, and is illustrated herewith, our engraving showing a plan view partly in section, with two drawheads in the act of coupling. The link is held to swing horizontally in the middle of the drawhead, and is formed with an extension pivoted in the back of the drawhead. The extreme inner end of the extension is forked, and adapted to be engaged by a weight swinging from above it in the center of the drawbar, the forks of the rear end straddling the weight to hold the link in an inclined position in relation to the longitudinal axis of the drawhead. Instead of the weight, a spring may be employed to accomplish the same purpose. On one side of the link, in front of its pivot, is a curved plate, extending vertically in the drawhead opening, and adapted to be engaged by the link of the other drawhead. On top of this curved plate is an outwardly extending flange, on which rests the lower end of the coupling pin. The rear end of the link extension is engaged by a pin on the under side of a rod sliding in horizontal bearings, to the ends of which may be attached chains extending to the sides of the car. In coupling two cars, the coupling pins are placed in their uppermost position, both pins being supported on the outwardly extending flanges of the respective drawheads. The operator then, by means of the horizontal rod, swings the extension and its link into the position shown at the left in the illustration, causing the coupling pin to drop and hold the link in longitudinal position, adapted to engage the curved plate of the link in the other drawhead as the cars come together, the link of the other drawhead being thereby swung outward into its recess, while the coupling pin drops into the front end of the entering link.



BYRNE'S CAR COUPLING.

A New Deodorant.

Bromine has for a long time been recognized as being valuable in the treatment of gangrene and foul-smelling ulcers; but until recently its merits as an effectual and cheap deodorant have not been appreciated, according to the *New York Medical Journal.* It was brought into prominence a few months ago by Mr. Martin, the chemist of the Health Department of this city, who suggested its use upon the earth thrown up in laying the electric subways. As it is a by-product obtained in the manufacture of salt, and is not used extensively in the arts, it is sold at a very reasonable price—about seventy cents per pound. It has the property of precipitating the hydrocarbons of illuminating gas, and thus can be used to deodorize the earth exposed in excavations in the vicinity of gas mains. More valuable than this is its effect upon decomposing organic bodies, which it renders completely inoffensive. This property renders it particularly valuable for use in stables, privy vaults, urinals, cesspools, or in any place which may contain foul-smelling organic matters. It is soluble in about thirty-three parts of water; but a solution of this strength is not advisable, as there is a constant escape from it of the vapor of bromine, which is very irritating to the eyes and air-passages, and which may even attack wood and metals. For ordinary purposes it is used in solutions containing one part by weight to about eight hundred of water. In this strength it may be used freely without its affecting anything which it may touch. A few gallons used daily will remove all ammoniacal odors from stables, or a few quarts will thoroughly deodorize the entire plumbing system of an ordinary house. It also might be used with advantage upon ordinary house garbage, which usually becomes offensive so speedily in warm weather. There would appear to be scarcely any limit to its usefulness in this branch of sanitary science; and it will, as soon as its merits are better known, undoubtedly be adopted universally as a substitute for the deodorants now in use, which usually act by substituting one unpleasant odor for another. The only drawback in its use lies in the fact that the undiluted bromine is strongly corrosive, and, if it touches the skin, causes a painful burn. Where it is used in large quantities, this can be obviated by opening the bottle, or, what is simpler, breaking it, under water. As its use becomes more extended, it will undoubtedly be put up in pearls or tubes containing only as much as would be needed at one time in the average household.

The United States Navy.

Our readers are aware that the United States have determined upon making great additions to their navy. At the same time a navy is not built in a day, even by American energy; and it will be seen from the details which we are about to give that a good deal has yet to be done before the country will possess a navy of even respectable importance from a European point of view. The additions to the American navy may be divided under two heads, the first comprising unarmored vessels and the second armored vessels. Of the unarmored vessels, four are already in commission, viz., the Dolphin, 1,485 tons and 2,240 horse power; the Boston, 3,189 tons and 3,780 horse power; the Atlanta, 3,189 tons and 3,350 horse power; and the Chicago, 4,500 tons and 5,084 horse power.

The Dolphin carries one 6 in. rifle gun; the Boston, two 8 in. rifle guns and six 6 in. rifle guns; the Atlanta, two 8 in. rifle guns and six 6 in. rifle guns; and the Chicago, four 8 in. rifle guns, eight 6 in. rifle guns, and two 5 in. rifle guns.

Five other unarmored vessels were recently launched, and will shortly be put in commission, viz., the Charleston, 3,730 tons and 7,000 horse power; the Baltimore, 4,413 tons and 9,000 horse power; the Yorktown, 1,700 tons and 3,000 horse power; the Petrel, 890 tons and 1,100 horse power; and the Vesuvius, 725 tons. The last named vessel is a dynamite cruiser, which is expected to steam at the rate of 20 knots per hour.

The Charleston will carry two 8 in. and six 6 in. rifle guns; the Baltimore, four 8 in. breech-loading rifle guns and six 6 in. breech-loading rifle guns; the Yorktown, six 6 in. breech-loading rifle guns; the Petrel, four 6 in. breech-loading rifle guns; and the Vesuvius, three 15 in. dynamite guns. In her trial trips before a board of United States naval officers, the Vesuvius has developed a speed of nearly 21½ knots per hour, so that she has more than realized the anticipations and estimates made respecting her. Her three 15 in. dynamite guns will render her one of the most formidable vessels in the American navy.

Six other unarmored vessels are being built, viz., the Newark, 4,083 tons burden and 8,500 horse power; the Philadelphia, 4,324 tons, and to attain a speed of 19 knots per hour; the San Francisco, 4,083 tons, to attain a speed of 19 knots per hour; the Concord, 1,700 tons and 3,400 horse power; the Bennington, 1,700 tons and 3,400 horse power; and a first class torpedo boat, not yet named, 99 tons, to steam at the rate of 23 knots per hour.

The Philadelphia is to carry twelve 6 in. breech-loading rifle guns; the Concord, six 6 in. breech-loading rifle guns; the Bennington, six 6 in. breech-loading rifle guns; and the torpedo boat, eight locomotive torpedoes.

Six other unarmored vessels have only reached at present the projection stage. These vessels are a cruiser of 5,300 tons, to steam at the rate of 20 knots per hour; two other cruisers of 3,000 tons each, to steam at the rate of 19 knots per hour; two other cruisers of 2,000 tons each, the speed of which is still unsettled; and a practice ship of 800 tons.

As regards the new armored vessels of the United States navy, they are in a less forward state than their unarmored contemporaries. There are seven armored ships at present being built, viz., the Maine, 6,648 tons and 9,000 horse power; the Texas, 6,300 tons and 8,000 horse power; the Puritan, 6,060 tons and 3,058 horse power; the Terror, 3,815 tons and 838 horse power; the Miantonomoh, 3,815 tons and 1,030 horse power; the Amphitrite, 3,815 tons and 1,000 horse power; and the Monadnock, 3,815 tons and 3,000 horse power.

The Maine will carry four 10 in. and six 6 in. breech-loading rifle guns; the Texas, two 12 in. and six 6 in. breech-loading rifle guns; and the Puritan, the Terror, the Miantonomoh, the Amphitrite, and the Monadnock will each carry four 10 in. breech-loading rifle guns. Plans have been prepared, but the building has not yet been commenced, of a vessel intended for coast defense. She is proposed to be of 4,000 tons burden and 5,400 horse power. This at present unnamed vessel will carry one 16 in. 115 ton breech-loading rifle gun, one 12 in. 48 ton breech-loading rifle gun, and one 15 in. dynamite gun. An armored cruiser not yet named, and proposed to be of 7,500 tons burden, is also in contemplation, but has not yet been commenced.

In closing these details, we may add that Great Britain has now 10 war vessels of 3,000 tons and upward, with a minimum speed of 19 knots per hour; the United States, 8; France, 5; Spain, 3; Japan, 2; and Russia, 1. The United States, accordingly, now claim that in the important matter of high speed war ships they now rank second, and are not far behind Great Britain. The Americans are, in fact, going in heavily for high speed cruisers.—*Engineering.*

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE. — Arthur Tickle, Brooklyn, N. Y. A piston is mounted to rotate within a cylinder, a gate being held to slide in the cylinder and forced against the piston by live steam, there being a steam chest on top of the cylinder, with a slide valve, with which exhaust valves simultaneously move, and other novel features, designed to utilize steam to the fullest advantage, and be readily reversed.

SPEED INDICATOR.—Elumet N. Barber, Kent, Ohio. This invention covers various novel details and combinations of parts, and is based on the principle of forcing a certain volume of liquid, as alcohol, oil, etc., through an aperture at a certain pressure in a certain time, the volume being increased or diminished without changing the pressure or the time, by increasing or decreasing the size of the aperture.

SPEED INDICATOR.—The same inventor has patented a further invention covering a compartment in which operates a piston actuated by the pressure of a continuous stream of a fluid forced into the compartment by a device actuated by the moving part the speed of which is to be indicated, the second compartment being filled with the same fluid and having a piston which compels the other piston to change its position slowly, in connection with a dial and pointer operated from the main shaft.

FURNACE.—Gottfried Pietzka, Witkowitz, Moravia, Austria-Hungary. This is a rotary double flame furnace, for use in puddling or welding pig iron, or for manufacturing Martin steel, the furnace being adapted to be turned so as to avoid loss of heat and time in clearing away the iron, and also to increase the quantity and improve the quality of the product, the invention covering various novel details and combinations of parts.

Electrical.

CURRENT REGULATOR. — Joseph W. Balet, New York City. This invention combines a series of storage batteries with a series of switches under control of the main current and the motor, by which the current not used and any surplus will be sent into accumulators to be stored for future use, and to control the charging of the secondary batteries, so that the current shall cease in a particular battery when the maximum charge is reached.

CURRENT REGULATOR.—The same inventor has patented a further invention consisting in a translating device formed of a helix and a pair of soft iron bars supported movably in the helix, each bar being connected with a switch arm adapted to move between a pair of contacts connected with the circuit in which the helix is placed, the device being adapted for use in connection with any electrical circuit, but especially for use with storage batteries.

Mechanical.

WIRE DRAWING MACHINE.—Frederic Smith, Halifax, York County, England. This machine is arranged to draw several wires simultaneously, each wire being reduced by drawing it through a series of dies by means of drawing-through pulleys driven at gradually increasing speeds, the objects of the improvement being to increase production and diminish the cost of such machines.

SHUTTLE MOTION.—William F. Hitchcock, Homer, N. Y. By this invention the shuttle is carried back and forth in a positive manner, and not thrown, the shuttle being adapted to hold a circular disk bobbin that carries the filling thread or wire, and actuated by hollow shuttle carriers, the automatic catching and releasing of the shuttle from the carriers forming an important feature of the invention.

DRILLING MACHINE.—Richard Hammond, Buffalo, N. Y. This is a central drilling tool, with two outer drilling tools held parallel therewith, and mounted in bearings to swing from the central tool, making a multiple drilling machine especially adapted for drilling apertures for the rivets in boilers when the plates are in place.

RAIL DRILL. — Meritt W. Smith, Waverly, N. Y. This is a machine which has a frame carrying a rotating and endwise movable spindle, with gearing for rotating the spindle, and other novel features, especially adapted for drilling fish plate bolt holes in railway rails, with economy of time and labor, the drilling tool being automatically fed.

SCREW DRIVER. — Carl A. Strasser, Baltimore, Md. This is a compound tool intended for use by piano makers and repairers, carpenters and others, and is designed for use in turning screws in corners or other obstructed positions, while it has a handle bar with notches or slots to receive pins or wires, to straighten them when bent.

WRENCH.—Joseph Tomlinson, Folsom, Cal. This invention covers a novel construction and arrangement of parts in that class of wrenches in which the jaws are pivoted within a frame or casing and are caused to clamp the nut by a sliding handle engaging the rear end of the jaws, and in which the lever jaws can be held locked in a closed position when desired.

STAVE MAKING MACHINE.—William J. Wright, Cooperstown, Pa. This is a machine wherein the billet passes through the various stages necessary to complete the stave, and as it progresses, automatically controls and sets the cutting devices so as to cut both the bevel and form the bilge of the stave in exact proportion in relation to the width of the billet.

Agricultural.

DRAG AND HARROW.—John R. Goodman, Calumet, Mo. The drag and harrow are each composed of jointed sections, the two being hinged together so that they may be used interchangeably if desired, or the drag may be used to break the clods and level the ground, while the harrow following just behind will loosen up the soil and prepare it for seeding.

STACKER.—Thomas Berry, North Fork, Ky. Combined with a base frame is a vibratory and vertically rocking table mounted thereon, and a trunk mounted upon the table, wherein the straw or hay will be continuously conveyed from the thrashing machine and deposited at a distance in advance of the trunk in a semicircular rick.

SHOCK BINDER. — Christian Beu, Moline, Kansas. This invention relates to a light and readily portable device for compressing shocks of corn or grain, while also providing a means for expeditiously and conveniently tying the shocks when compressed, the invention covering various novel features of construction and combinations of parts.

GRAIN SCOURER. — Peter Provost, Menominee, Mich. This invention covers novel details and combinations of parts in a machine for scouring and cleaning grain, in which the process is facilitated by causing the kernels to rub against each other and against the several parts in the interior of the main cylinder of the machine.

Miscellaneous.

MEAT BROILER.—Annie Caller, Albany, N. Y. This broiler consists of a folding skeleton frame so connected to guide rods on the base as to be readily moved to either end of the base and either member of the frame presented to the fire, to provide for the ready turning of the meat without removing it from the broiler and without removing the latter from the fire.

STOVE OR RANGE.—George G. Kniffin, Brooklyn, N. Y. This invention provides a counterbalance drop door specially adapted for use at the oven, the door being attached in a simple and durable manner, and means being provided whereby the doors will be easy of access in case repairs are needed.

FRUIT DRIER. — Henry A. Crandell, Harrison, Ark. The drying chamber of this apparatus has movable supports on which the trays rest, projecting into the chamber, and a rotary shaft with eccentric disks which engage and move back the supports and release and lower therefrom one tray at a time, the green fruit being introduced at the top of the chamber, and removed from the bottom when dried.

STEAM RADIATOR.—Daniel H. Streeper, Norristown, Pa. This invention covers an apparatus in which are combined telescopic tubes for regulating the discharge of water from steam radiators, for the purpose of varying the steam room of the radiator, according to the amount of heat required.

NEEDLE.—Samuel M. Neely, Smith's Turn Out, S. C. This is an eye point needle designed to be used by hand for sewing bags and other coarse work, and is adapted to carry its own ball of thread, while the needle may be of the longitudinally grooved description or otherwise.

FOLDING STEP. — Harrison T. Cork, Marshall, Ill. This step consists essentially of a casing with a spring plug and arranged for connection with a vehicle body, a standard moving vertically within the casing, and a step hinged to an arm carried by the standard, making a vehicle step adjustable as to height, and which can be folded out of the way when not in use.

TRUNK FASTENER.—Joseph R. Shoemaker, Durango, Col. This is a corner brace for trunks, valises, and similar articles, to facilitate roping and strapping the trunk or package after it has been locked, whereby the rope is kept in place and prevented from slackening and slipping off, and the binding rope is prevented from being cut by the angular portions of the trunk.

DUMP CART. — Hartwell A. Wilkins, New York City. The cart body is rigidly mounted upon a cranked axle to which the shafts or thills are connected by hinge joints, the body being held from accidental dumping by a tongue carried by a vertical crank shaft and engaging a keeper secured to the body.

SHIPPING PACKAGE.—Isaac L. Rock, Mooers, N. Y. This invention provides a simple and inexpensive fastener for the covers of butter tubs, pails, etc., a square loop being pivotally connected to one side of the pail and a loop to the opposite side, upon the free end of which turns a cam lever, the lever being turned downward over the cover to hold the latter in place.

GATE.—George Ford, New Harmony, Ind. This gate is made with inclines, means for lifting the gate, and bearings for the inclines of the gate, such bearings being movable, giving a compound movement of the gate, part by the movement of the bearings in their guides and part by the inclines of the gate moving down the bearings.

DYNAMITE.—John Waffen, Hancock, Mich. This invention covers a new composition of matter to be used as a high explosive, the composition not being affected by moisture, and not susceptible of change except when exposed to a temperature exceeding 110° F. It consists mainly of nitrate of soda, decayed wood, sulphur, carbonate of soda, and nitroglycerine having collodion mixed with it.

INSECTICIDE. — James M. A. Miller, San Mateo, Fla. This invention covers a process of producing an insect-destroying compound especially designed for use on fruit trees, and consists in adding sulphur to lime while the latter is being slaked and afterward dissolving the ingredients in water.

FULLING WOOLENS.—Reuben C. Rutherford, New York City. This invention covers a method of restoring shrunken woolen fabrics to their original dimensions and texture, the method consisting in first steaming the fabric to soften the fibers, then stretching the steamed fabric while moist and heated, and finally drying the fabric.

CAMERA SHUTTER.—William Shakespeare, Jr., and Garrett W. Low, Kalamazoo, Mich. This invention relates to camera shutters, in which a pair of swinging slides or wings arranged to approach and recede from each other are used to cover or expose the opening in the camera which faces the lens through which light is admitted when making an exposure, the invention covering special means for operating the slides, and special construction for taking stereoscopic pictures, with various other novel features.

HARMONIGRAPH. — Joseph A. Decuir, New Orleans, La. This is an apparatus by which music, as played on a piano or other instrument, may be suitably indicated on a sheet of paper, the construction being such that paper is fed steadily forward and lines drawn thereon, the lines being broken by depressing the keys, the breaks in the lines indicating the notes, and the length of the breaks indicating the time due the notes.

PAVEMENT.—Murty Cunningham, Bellefonte, Pa. This is a composite pavement, the composition consisting of broken stone or its equivalents, coke screenings or screened coal ashes, coal tar, sulphur, a coloring material, and tallow, there being applied to the top layer a mixture of coal tar, sulphur, coloring material, and hot tallow, the composition being about five inches thick, in several layers, where the wear is heavy.

STOVE PIPE VENTILATOR.—George L. Jones and Eusebius M. M. Miles, Chippewa Falls, Wis. This is an attachment for the draught pipes of cook stoves, in which a hood is held over the stove to receive the smoke, gases, etc., the improvement providing for the ready adjustment of the hood to give convenient access to the stove, and affording means for moving parts of the hood without disturbing the remainder.

SAFETY GUARD FOR RAZORS.—Terence F. Curley and Albert S. Granger, Brooklyn, N. Y. Combined with a tubular razor back pivoted in a handle is a razor blade inserted in the back and a swinging reversible guard pivoted upon the razor back, and capable of swinging against either side of the blade, the reversible guard having oblique ribs or corrugations on opposite sides.

SAFETY GUARD FOR RAZORS. — The same inventors have patented a further invention in which, combined with a slotted tubular back, provided with a hollow shank and a razor blade held by the back, is a guard which may be swung back from the edge of the razor blade, to permit of shifting the blade and sharpening the razor, the object of the guard being to prevent the razor from cutting the flesh.

PARALLEL RULER.—Sherman M. Goss, Council Bluffs, Iowa. This rule consists of a blade connected by links with a second blade extending parallel with the first one, both blades being provided with inclined flanges having graduations.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(508) F. S. asks: 1. Can you tell me which will weigh the heaviest, salt (sea) or fresh water, and if any difference? What is the cause? A. Sea water is the heavier, because of the salt dissolved in it. 2. My parents were born in Germany, I was born in America. Am I American or German-American? A. You are American. 3. What causes earthquakes? A. The cause is unknown.

(509) J. A. C. writes: In our water works system at this place we are troubled with the flow of water stopping at the bibs with good pressure in mains (30 to 40 pounds) and good flow next door. There is no more sign of pressure than there would be with stop shut; the water will start again of its own accord, it may be in 10 minutes, and may be in 2 or 3 hours. Every one tells us it is an air trap. Now what we want to know is, what is an air trap, with the reason why the water will not flow through a pipe with one end open to the atmosphere and the other under pressure? A. Probably your main pipe is too small for the service. With small mains and many service pipes, where at certain times many are drawing water at the same time, at the lowest level the bibs will run and draw air in at open bibs on a higher level, the air becoming an obstruction by retarding the flow of water to

lower levels, the air always seeking the highest points in the system of mains. This is called an air trap. The high points in the system should have self-acting valves or a service connection to let the air out, but this will not obviate the tendency to air obstruction in mains that are too small for a distributing service. We could not point out your special trouble without a map and elevation of the whole system of mains. Service pipes should always be tapped in to the top of the mains.

(510) E. L. B. asks: How many ohms of resistance will one volt of E. M. F. overcome? I can read up all about one unit and all about the other unit, but cannot ascertain the relation between the two. If there were a unit for the friction of water in a pipe, it would be easy to say, so many pounds of pressure overcome so many units of friction; cannot the same be ascertained for volts and ohms? A. Any number of ohms resistance can be overcome by one volt E. M. F. The resistance simply reduces the amount of current that can be produced by a given E. M. F. through the circuit. Thus, taking your own simile, no amount of friction could completely overcome one pound of water pressure; it would only reduce the amount which that pressure could force through the pipe. Read Ohm's law to ascertain the relation of E. M. F. to current. It states that the current produced by a given E. M. F. is inversely proportional to the resistance of the circuit. Hence any E. M. F. must produce some current through any resistance short of infinity.

(511) C. T. H. asks how to calculate the size of wire on armature and field magnets of electric motor with any given E. M. F. A. For a peripheral speed of armature of about 1,500 feet per minute, and as an approximation, for every yard of wire in its winding, one volt E. M. F. may be allowed for.

(512) V. M. C. asks: How must I proceed to obtain a cast of solid metal, say of silver, of a bug, beetle, or similar insect? The idea is to embed the object in some plastic refractory material, then burn it out, and pour the molten metal through holes provided. What material must I use, and how must I proceed? A. Make the moulds of finely ground plumbago 3 parts, potter's clay 1 part. Mix thoroughly with water, and thin enough to run. Make a small paper box open on one side, and impale the insect on large pins passed through the box and into the insect to hold it in position and for ventilation. Let some of the pins touch the legs, also for ventilation. When the insect is properly adjusted in the box, and a large pin or pouring gate is made to touch the body, and held in place by passing through the box, pour the thin mixture slowly into the box until it is filled, being careful to clear away any air bubbles that might hang in contact with the insect. Set the mould in a warm place to dry. As soon as it is set or hard enough to handle, pull out the pins and gate and take off the paper box and place in a warm place to thoroughly dry. Then place it in a small iron box, so as not to expose the mould to sudden heat, and slowly heat to a full red, and while at a red heat blow air through the mould to burn any carbon that may remain. See that the vent holes and gate are all clear, when the mould will be ready for pouring in the metal. Have the mould quite hot when you pour, to insure the metal filling every part. Soak the mould in water for a few hours, when it can be cut away with a knife.

(513) M. C. J. and L. J. S. ask how marble that has become stained so that it looks dirty can be whitened. A. Scrub it with ground pumice stone and water. For stains apply a paste of lime and washing soda and wash off after a few hours. Also try javelle water, or bleaching powder and water mixed to a paste.

(514) H. N. asks how table oil cloth may be made. A. Size it with weak glue solution and paint with best lead paint, mixed with a little varnish. It can be rubbed down between successive coats with ground pumice if a very fine finish is desired. Dammar varnish can be used.

(515) A Subscriber asks why they don't use emery paper on an electric motor. A. Emery is a bad material to use on any frictional surfaces or bearings in any class of machinery, as it beds itself in the metal and cuts the journals, etc. Hence it is not used to brighten the commutators, as they would then destroy the brushes.

(516) J. H. A. writes: I wish to take a plaster cast from a plaster ornament, but have trouble in separating same. Can you tell me what to use on the original so that they will admit of free separation? A. Oil the mould with olive or similar oil.

(517) T. O. M. asks: Will the telephones described in SUPPLEMENT, No. 142, work a distance of ten miles? A. No; you will need a microphone transmitter. 2. Would I be permitted by Bell Telephone Company to use them? A. They are practically Bell telephones, and the Bell company can have you enjoined from using them.

(518) N. W. H. writes: In your SCIENTIFIC AMERICAN of February 18, 1888, you give the population of London, England, for 1888, 3,955,819. Swinton's geography gives the population of same city for 1880, 4,764,000. Has the city decreased in population, or have you made a mistake? A. Our figure was correct. The population of London may be variously stated, according to the districts in the suburbs which are included. In stating the population of New York as a center of population, Brooklyn, Jersey City, Hoboken, Long Island City, etc., should be included. London's population is increasing with great rapidity.

(519) E. H. J. asks: 1. Please give origin and history of three golden balls as a pawnbroker's sign. A. The coat of arms of Lombardy contained three spheres, and is said to have been the origin of the pawnbroker's sign, as Lombardy was the home of some of the first of this class. 2. Is there a treatise on the improvement of memory? A. Holbrook's "How to Strengthen the Memory" is a popular treatise, which we can send free by mail for $1.00.

(520) J. S. writes: I have constructed an eight lamp (16 c. p.) dynamo-electric machine, according to instructions given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, by G. M. Hopkins, but have failed to generate any current from it. The instructions given have been strictly followed. The machine runs well as a motor with four Grove cells. Will you please inform me the reason, or suggest what is necessary to obtain the desired effects? A. Possibly you can obtain a current by shifting the wires of the field magnet so as to send the current through the field in the opposite sense. Or try the following: Connect the field and armature in series with a battery of four or five couples and start the dynamo. Have the wires insulated and the brushes set at the neutral point. The instant the belt seems to drag, indicating an excited field, cut the battery out and close the circuit. This must be done quickly or you may lose the excitement of the field. Do not touch the bare wires when executing the maneuver, or you will get a strong shock.

(521) F. B. W. writes: Will you kindly inform me through your paper the process of making blue print paper—body white, lines blue? I have seen it in your paper, but cannot turn to it. A. For processes both of blue lines on white ground and black lines on white ground, we refer you to our SUPPLEMENT, No. 584, with full description, formula, etc.

(522) J. G. W. writes: I am building an eight light dynamo as described in SUPPLEMENT, No. 600. 1. I wish to use it for an arc light; which is the best winding for it—series or shunt? A. For arc lamp wind in series. 2. Could it be run by hand power with proper transmission for several hours? A. It would not be practicable. 3. Which is the best transmission for it? A. Belting. 4. How can I make an arc lamp for that purpose? A. For arc lamps consult our SUPPLEMENTS. We recommend also Atkinson, "Electric Lighting," which we can supply by mail for $1.50.

(523) J. V. L. P. writes: Can you tell me what has been found efficacious for removing mildew from brickwork? A brick building near here has presented about 100 square feet of mildewed surface on one of its gable ends ever since it was built, some eighteen months since. The mildew is a clear white, and varies a little from time to time in extent, but is as bad now as ever. I have thought of using several liquids for removing it, but would be glad to learn what others have found suitable. Perhaps nitric acid would destroy the mildew, but I fear it would eat into the mortar at the joints and necessitate repointing. How is it with boiling water, kerosene, lye, or ammonia? Will the application of any substance prevent the reformation of the mildew—boiled linseed oil, perhaps? A. Builder's acid (muriatic acid) is often used for removing white stains from brickwork. Its efficacy in the case of mildew would be doubtful, but the white stains you refer to may not be such. A coat of linseed oil on the perfectly dry brick would have a good preventive tendency. Melted paraffine applied hot and worked in with a paint burner would also be efficacious. Perhaps either of the last named applications would destroy the mildew or white stain also. Acid used by an experienced man would not injure the joints.

(524) A. L. K. writes: A shunt-wound incandescent dynamo, voltage 1,200, current 5 amperes, furnishes light for 100 16 candle lamps, wired in series. Each lamp has 2½ ohms R. and consumes 12½ volts. An arc lamp is inserted in the circuit, in series, requiring 50 volts and 5 amperes, and giving a nominal candle power of 1,000. It displaces four 16 candle lamps. I cannot understand why the same power furnishes 64 candle power in one case and 1,000 in the other. A. The 1,000 candle power rating is fictitious, and really is about 400 candles. The arc lamp is the most economical producer of light that is known, because of its high temperature. The ratio of obscure to luminous radiations is far more favorable than in the case of the incandescent lamps.

(525) "Reader" asks: Is not the field for invention nearly exhausted? Do you know of any opportunities still open for one with an inventive turn of mind? A. The opportunities are endless; the field is rather increasing than diminishing. We could not recapitulate a tithe of the most important. Thus we might suggest a light weight durable storage battery; a low resistance, compact, cheaply run primary battery; a high temperature heat engine; a practicable freight train brake; a coupling for attaching automatically ferryboats to their docks; a practicable system of navigation in fogs on the ocean. Every machine of importance can be made the basis for improvements. To be a successful inventor you must see the need as well as the way of supplying it; the first is as essential to success as is the second.

(526) P. V. M. asks whether common pine wood or any wood could be made to answer for cores in casting Babbitt or lead. If not ordinarily, could it be made good by any solution? A. Boil the wood for a few minutes in a strong solution of sulphate of iron, dry, and whitewash with lime and again dry, for each cast.

(527) A. A. asks if there is any method to separate alkali from water to make it suitable for drinking. A. Distillation is the only efficient method.

(528) B. & Co. ask for the best methods of quickly bleaching ivory. A. Treat with solution of binoxide of hydrogen. Exposure to the sun while immersed in spirits of turpentine is said to be efficacious.

(529) H. A. W. asks: Kindly state between what zodiacal constellations and the sun are the planets Saturn, Uranus, and Neptune when passing the perihelion point of their different orbits. A. The position of the perihelion of Saturn is in Cancer, of Uranus in Virgo, of Neptune in Taurus.

(530) E. J. K. writes: Will you give formula for adhesive plaster that is unaffected by moisture and is as inert, medicinally, as possible? What is wanted is something that will stick to the body well. A. Oxide of lead 4 pounds, olive oil 1 gallon, water 3½ pints; simmer together for four or five hours, adding water if necessary until the mass is of proper consistence.

(531) F. H. S. writes: At any time during clear weather, when the temperature is below the freezing point during the night, but not sufficiently low as to "freeze over" the water of a river or creek, at no time before sunrise can a particle of ice be seen upon the surface of the water, while in a short time after sunrise, the stream, as if by magic, is filled from shore to shore with floating particles of ice, commonly called slush ice. Query: Whence comes this ice? A. The fine ice we presume existed, but was invisible until the sun's rays fell upon it not too obliquely.

(532) J. S. B. writes: To settle a dispute, will you please tell me, if you should pass an electric current through a chemically pure copper wire, would there be any difference in composition (*i. e.* would it still be chemically pure) or structure? I think that an electric current would not alter the composition or structure, unless the wire was so small as to cause heating. A. You are correct. No alteration in composition will be produced.

(533) E. H. D. writes: Is there anything in benzine that will injure the teeth? If not, it is certainly a great cleanser. How can it be purified from its peculiar taste and smell? A. Benzine will not injure the teeth, but is not adapted for cleaning a wet surface, and its vapor, if inhaled, would tend to produce toxic symptoms. Treatment with bichromate of potash and sulphuric acid tends to destroy its odor.

(534) G. S. D. asks: 1. Why is it that you can place your hand on the bottom of a boiling tea kettle and it will not burn you, only feeling warm to the naked hand? A. If the bottom of the kettle is coated with a non-conducting substance, such as lampblack, the heat will be prevented from reaching the hand in some measure. If the bottom is clean, it will feel hot. 2. How are lenses adjusted in instantaneous photograph cameras to focus themselves correctly at different distances? A. The lens is so constructed as to keep the emergent rays as nearly parallel as possible, so that the approximate focus is what is known as a deep one.

(535) H. B.—Condensation of natural gas to a liquid is impracticable on the large scale, and cannot be accomplished on the small scale without extreme reduction of temperature. Aluminum steel is ductile if properly annealed. Experiments with aluminum alloys for ordnance have yet to be made. The U. S. government has in contemplation experiments with submarine boats.

(536) S. H. M. writes: Please be kind enough to explain the following phenomena of the water hammer: 1. When friction is applied to the tube, the bulb at the upper end being full of water, all but a bubble, a sort of boiling takes place through the contracted tube immediately below the bulb? A singing noise accompanies it. 2. When the thumb is applied to the lower end of the tube where there is a slight bulge, the tube being inclined just sufficiently to allow a small bubble to remain in the bulge, the instrument seems to serve as an accurate pulse glass, and indicates the pulse beats. A. Both phenomena are du to heat produced by friction or contact. The pulse indication is, we believe, quite imaginary, and if the bubbling agrees with the pulse-beat, it is a coincidence only.

(537) M. K. writes: Considerable annoyance is caused in our bleaching works by the soda imparting to the materials to be bleached a reddish tinge, which is very positive in its resistance to the bleaching agent—chloride of lime solution. Will you please say if there is anything in the soda that would be likely to produce this result, and if there is anything that will neutralize it? A. We presume the trouble is due to the presence of iron. Treatment of the goods with a weak acid bath might remedy it.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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